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THE
ACADEMY OF NATURAL SCIENCES
OF
PHILADELPHIA.

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J. T. W. D.

The British Mycological Society.

(Recognosce notum, ignotum inspice.)

(ESTABLISHED 1896).

TRANSACTIONS

1897-1901.

VOL. I.

EDITED BY CARLETON REA.

ACADEMY OF NATURAL SCIENCES
AUG 28 1917
OF PHILADELPHIA

WORCESTER:
EBENR. BAYLIS & SON, STEAM PRINTERS, 22, THE CROSS,
AND TRINITY WORKS.

The British Mycological Society.

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TRANSACTIONS

FOR THE

Season 1896-1897.

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The British Mycological Society.

(*Recognosce notum, ignotum inspice*).

LIST OF FOUNDATION MEMBERS.

1. Bairstow Mr. U., Heath Crescent, Halifax.
2. Birks Mr. Thomas, Moss Lodge, Kings Road, Rochdale.

3. Carr Professor J. W., M.A., University College, Nottingham.
4. Cheeseman Mr. W. Norwood, The Crescent, Selby.
5. Clarke Mr. A., 9, Saint Andrew's Road, Huddersfield.
6. Clarke Dr. Fielding, Foregate Street, Worcester.
7. Clarke Rev. F. K., Orcheston, Malvern Wells.
8. Cooke Dr. M. C., 145, Junction Road, London, N.
9. Crossland Mr. Charles, 4, Coleridge Street, Halifax.

10. Douglas Mr. A., Balderston Park, Thirsk.
11. Dublin Naturalists' Field Club.
12. Du Port Rev. Canon J. M., M.A., Denver Rectory, Downham, Norfolk.

13. Edwards Mr. W. H., Curator Hastings' Museum, Victoria Institute, Worcester.
14. Eyre Rev. William L. W., M.A.. Swarraton Rectory, Alresford, Hants.

15. Fisher Mr. H., 45, Hampden Street, Nottingham.
16. Fitz-Gerald Rev. H. P., F.L.S., Barracane, Wellington College, Berks.
17. Fowler Rev. W., M.A., Liversedge Vicarage, Normanton.

18. Gardner Mr. Fred, 11, Nevill Street, Abergavenny.
19. Gelsthorpe Mr. Thomas, Eastgate, Louth.
20. Gibbs Mr. Thomas, 4, Grange Street, Burton-on-Trent.

21. Hey Mr. T., 8, Bloomfield Street, Derby.

22. Louth Antiquarian & Naturalists' Society.

23. Magnus Herr Dr. P., Professor of Botany in the University of Berlin, Blumer Hof 15, Berlin.
24. Massee Mr. George, F.L.S., Royal Herbarium, Kew.
25. Massee Mrs. George, 1, Kent Road, Kew, Surrey.
26. Mason Dr. Philip B., Trent House, Burton-on-Trent.
27. McWeeney Dr. Edmunds, M.A., 84, Saint Stephen's Green, Dublin.

28. Needham Mr. J., Woodend, Hebden Bridge.
29. Nicholson Mr. W. A., 3, Oxford Street, Norwich.

30. Peacock Dr. H. G., The Lawn, Malvern.
31. Pim Mr. Greenwood, M.A., Easton Lodge, Monkstown, Co. Dublin.
32. Plowright Mr. Charles B., M.D., Kings Lynn.
33. Potter Professor M. O., M.A., Durham College of Science, Newcastle-upon-Tyne.

34. Rea Mr. Carleton, B.C.L., M.A., 34, Foregate Street, Worcester.
35. Rehm Herr Dr. N., Regensburg, Oberfalz, Germany.
36. Robinson Mr. J. B., Saint Mary's Lane, Louth.
37. Rose Miss E. A., 17, The Tything, Worcester.
38. Rose Mr. John, President of the Worcestershire Naturalists' Club, 17, The Tything, Worcester.

39. Salmon Mr. Ernest, Clevelands, Reigate, Surrey.
40. Slater Mr. M. B., F.L.S., Yorkersgate, Malton.
41. Soppitt Mr. H. T., 10, Glen View, Clover Hill, Halifax.
42. Spofforth Mr. S. G. N., The Hill, St. John's, Worcester.
43. Sutcliffe Mr. J., 125, Church Street, Paddock, Huddersfield.
44. Sutcliffe Mr. J. W., 27, West View, Halifax.

45. Trail Professor James W. H., M.D., F.R.S., The University, Aberdeen.

46. Wager Mr. Harold, F.L.S., Bank View, Chapel-Allerton, Leeds.
47. Ward Professor H. Marshall, M.A., F.R.S., F.L.S., University Botanical Laboratory, Cambridge.
48. Weiss Professor F. E., F.R.S., Owen's College, Manchester.
49. White Mr. J. Hill, F.R.H.S., 54, Broad Street, Worcester.
50. Woolhope Naturalists' Field Club.

Officers for the Season 1896-1897.

President - - George Massee, F.L.S., Royal Herbarium, Kew.

Hon. Treasurer - Charles Crossland, Halifax.

Hon. Secretary - Carleton Rea, B.C.L., M.A., 34, Foregate Street, Worcester.

RULES.

Society's name and objects.

1. The Society shall be called "The British Mycological Society" and its objects shall be the study of Mycology in all its branches, systematic, morphological and pathological, the publication of annual reports recording all recent discoveries in any branch of mycology, and more especially giving a brief synopsis of the work of European Mycologists and the recent additions to the British Fungus Flora.

Members of Society.

2. The Society shall consist of Foundation Members, Honorary Members and Ordinary Members, the number of Foundation Members shall be limited to 100 and that of Honorary Members to 20, but the number of Ordinary Members shall be unlimited.

Foundation Members.

3. Foundation Members shall consist of those Members and Clubs who joined the Society previous to the limit of 100 Members of the Society having been attained, but after this number has been attained no Person or Club shall be admitted as a Foundation Member.

Honorary Members.

4. Honorary Members shall be Ladies or Gentlemen of pre-eminence in Mycology, or who have rendered special service to the Society.

Ordinary Members.

5. Ordinary Members shall be Ladies or Gentlemen elected as hereinafter set out.

Election of Members.

6. Until the limit of 100 Foundation Members be reached any person or Club may signify their desire of joining the British Mycological Society and will consequently be enrolled as Members thereof by the Secretary. Honorary Members shall only be elected at a meeting of The British Mycological Society by the majority of the Members then present. Ordinary Members shall be elected either by the majority of the Members then present at the annual meeting, or meetings, or by the President, Treasurer and Hon. Secretary at other times. All Ordinary Members shall be proposed and seconded respectively by existing Members, who shall sign a certificate (see appendix) in recommendation of him or her, one at least of the proposers so certifying from personal knowledge, and every candidate for election shall sign an undertaking to abide by the Rules if elected (see appendix).

Yearly Subscription.

7. All Ordinary Members shall pay an annual subscription of 10/- and Foundation Members 5/-, whilst Honorary Members shall be exempt from either entrance fee or annual subscription.

Government of the Society.

8. The management of the British Mycological Society shall be vested in the President, Treasurer and Hon. Secretary.

Election of Officers.

9. The President, Treasurer and Hon. Secretary, shall be elected annually, at the first meeting of the British Mycological Society in each year, by a majority of the Members then present.

Meetings or Forays.

10. The British Mycological Society shall hold one or more meetings annually at a place and time determined by the Members at the previous meeting, or in default thereof, by the President, Treasurer and Secretary. Invitations from Local Societies shall be first entertained and the acceptance of such shall imply that the Local Society undertakes to arrange the excursions of the foray, obtain necessary permissions from landowners, and place at the disposal of the British Mycological Society a room

for the exhibition of specimens, delivery of addresses, and the transaction of business.

Accounts to be annually furnished and vouched.

11. At the first meeting of the British Mycological Society in each year the Hon. Secretary shall produce an account of the receipts and disbursements for the previous year duly vouched by the Hon. Treasurer, or if the two offices be combined, then by an independent Member of the Society.

Payment of Expenses.

12. At each Meeting the Members then present must pay to the Hon. Secretary their share of the expenses incurred.

Election of Chairman in absence of President.

13. In the absence of the President the Members present at any meeting shall elect a Chairman for that Meeting.

Rarities to be recorded

14. Members finding rare specimens, or specimens new to the British Fungus Flora, are requested to immediately communicate the fact to the Hon. Secretary, together with full descriptions, the locality where gathered, and the date thereof, and the Hon. Secretary shall report the same at the next meeting of the Club.

EveryMember to have a copy of these Rules and any alteration thereof.

15. A printed copy of these Rules shall be sent to every Member of the Club on election, and to all Members on their alteration.

APPENDIX.

Form of proposal for Ordinary Membership of the British Mycological Society.

_____

of _____

_____

being desirous of becoming an Ordinary Member of the British Mycological Society, we, the undersigned Members of the Society, certify that we consider h to be a desirable Member of the Society and beg to recommend h for election.

Dated this day of 189

_____(From personal knowledge).

_____

Certificate to be signed by the Candidate.

I hereby certify that I desire to become an Ordinary Member of the British Mycological Society and that I will abide by the Rules if elected.

_____

SHERWOOD FOREST FORAY.

WELBECK, THORESBY, CLUMBER AND THE BIRKLANDS,

13th-18th September, 1897.

The first annual week's fungus foray was held in Sherwood Forest, Worksop being selected as a convenient centre from which the different portions of the Forest could be worked. On Monday, the 13th of September the members assembled at Worksop, where the Lion Hotel was constituted the headquarters, and there a room was set apart for the exhibition of fungi and the reading of papers.

Tuesday, the 14th of September, was devoted to an exploration of the woods on the Welbeck Estate, but owing to the recent drought that had apparently reigned for some time past, but few interesting fungi were collected, though *Tubulina cylindrica*, Rost, was very abundant on some saw-dust, and *Peziza sepiatra*, Cke, was found on a charcoal heap. From thence the walk was continued through various plantations till at last the remnants of the "Seven Sisters Oak" were reached, and the members were fortunate enough to obtain a sight of the white deer herd in the adjoining park.

In the evening, Mr. George Massee, F.R.M.S., F.L.S., delivered his presidential address on "Mycological progress during the past sixty years," a résumé of which appears hereafter. Mr. George Massee, F.R.M.S., F.L.S., was unanimously re-elected President, and Mr. Carleton Rea, B.C.L., M.A., Hon. Secretary and Treasurer, the then present Treasurer, Mr. Charles Crossland, advocating the combination of these two offices in one, as their division only entailed useless expenditure of the Club's funds. The Secretary then read a letter from Professor Johnson, on behalf of the Dublin Naturalists' Field Club, cordially inviting the British Mycological Society to visit Ireland next year under the auspices of their Club; this

invitation was unanimously accepted and the date* was subsequently to be so fixed as neither to clash with the British Association Meetings or with the Cryptogamic Society of Scotland. A hearty vote of thanks was unanimously accorded to Mr. George Massee for his very excellent and instructive address, and for the assistance he had given the Society during his year of office. The Hon. Sec. then brought before the notice of the members the curious way their Society had been treated by the Nottingham Naturalists' Society, which in the spring of the year, in response to a letter from him informing them of our intention of visiting Sherwood Forest, offered to assist us to the very utmost of their powers, but when the time arrived, had done nothing whatever to assist our Society. Mr. Carleton Rea then exhibited drawings by Miss E. A. Rose, of a *Coprinus* new to science, which he had named *C. roseotinctus*, by reason of its being characterized by the presence of deep rose coloured meal on pileus and stem. A full description of which will be found amongst the record of fungi new to Britain. Mr. E. Salmon exhibited a fine example of *Sparassis crispa* Fr., from Surrey, which was subsequently photographed by our member Mr. A. Clarke, and rumour says finally demolished by some ardent mycophagists at breakfast at the Lion Hotel.

On Wednesday, the 15th of September, the demesne of Thoresby was explored under the able conductorship of our member Professor J. W. Carr, M.A., of Nottingham University College, who met the Members at Budby. He first conducted the members into a low-lying damp moist wood known as Budby Carr. There microscopic fungi were found in abundance, and a considerable time was spent in exploring it, so that it was somewhat late before the members proceeded to explore the home park of Thoresby, but the following were noted on the way: *Armillaria mucida* Schrad., *Clitocybe decastes* Fr., *Entoloma majale* Fr., and *Leptonia serrulata* Fr. During the evening Dr. C. B. Plowright, of King's Lynn arrived, bringing specimens of *Lepiota polysticta* Berk., and *Geaster mammosus* Chev.

On Thursday, the 16th of September, the woods of Clumber were visited. This was an ideal day, the members being allowed to wander at their own free will through the Clumber estate, but unfortunately the drought before referred to militated against a good bag, and though the members worked diligently only the following are worthy of notice, namely: *Leptonia chloropolia* Fr., *Clitocybe incilis* Fr., the so-called *Clitocybe Sadleri* Berk. (stated by some authors to be a sterile condition of *Hypholoma fasciculare* Huds.), and *Collybia vertirugis* Cke. In the evening rules for the future regulation of the Society were passed, the limit as to foundation members, from 50 to 100 being only carried by the casting vote of the

* Monday to Saturday, 19th to 24th September, 1898. C. Rea.

President. Dr. Plowright then gave a short résumé of new species of the Uredineæ and Ustilagineae found during the past year, and exhibited specimens of *Urocystis Filipendulae*, Tul. from Mr. Tatum of Salisbury, and of the two species of Barley-smut, *Ustilago Hordei* and *Jenseni*. He pointed out in regard to these two latter, that until recently they had been taken as one species both by agriculturalists and mycologists, but recent investigation had shown that they were very distinct, the one was pulverulent and disappeared before harvest, leaving only a bare rachis, whereas the other was a malignant parasite present in the ears of corn, which not only made the sample dark and therefore of less value, but also if sown without a previous remedial dressing, ensured in the next year a diseased crop; this he ventured to think was of great consequence to the farmer. Mr. A. Clarke then read his promised paper on "Photography as applied to Mycology," illustrated by many splendid photographs of various species of fungi, and all present were agreed that no abler exponent of that side of mycology could have been found to set forth the advantages of such a reproductive process, and especial appreciation was expressed for his magnificent stereoscopic examples.

On Friday, the 17th of September, a long drive from Worksop brought the members to their trysting place, where their guide, Professor J. W. Carr, who somewhat impatient at waiting for the members at the appointed spot, met them shortly after they descended from the carriages. Under his kind conductorship a pleasant ramble was taken to the heart of the Birklands, which at the present day is the sole remnant of the ancient Forest of Sherwood. On the way *Amanita recutita* Fr. was found in some abundance, and the older trees, now living wrecks, were noted as being specially the habitat of *Polyporus sulphureus*, Fr., the condition of which Dr. Plowright attributed to this fungus, but other members not imbued with Hartig's views, thought that age and not that parasite were responsible for their condition. The members then reached the "Butchers' Shambles Oak" or "Robin Hood's Larder," and many interesting forms of fungi were here noted, amongst which we may enumerate a lovely group of *Pholiota adiposa*, Fr., and numerous examples of *Collybia vertirugis*, Cke. At the shooting box the carriages met the members, and thus terminated a most enjoyable week's ramble in search of fungi. In the evening, a hearty vote of thanks was accorded to the Dukes of Portland and Newcastle and Earl Manvers, for the kind permissions that had been granted for visiting their estates. Over three hundred species were gathered during this foray, but as the majority were common ones, only the most interesting are enumerated in the subjoined list.

LIST OF THE MORE UNCOMMON FUNGI AND MYXOGASTRES OBSERVED IN SHERWOOD FOREST, 14-17 SEPT., 1897.

Where no note is mentioned the species were noticed universally, otherwise

B=Birklands, C=Clumber, T=Thoresby and W=Welbeck.

Amanita recutita Fr., C. & B. fide Dr. C. B. Plowright and C. Rea.
Lepiota prominens Viv., W. & B.
metulaespora B. & Br., C.
felina Pers., W. & C.
charcharias Pers., B.
Armillaria mucida Schrad., T. & B.
Tricholoma panaeolum Fr.
melaleucum Pers.
Clitocybe decastes Fr., T.
incilis Fr., T. & C.
Sadleri Berk.
Collybia vertirugis Cke., C. & B.
Mycena iris Berk., C., fide Dr. C. B. Plowright.
Pluteus cervinus Schaeff var eximius Smith., W. & C.
var patricius Schulz., W. & B.
Entoloma majale Fr., T.
costatum Fr.
Leptonia serrulata Fr., T.
chloropolia Fr., C.
Pholiota adiposa Fr., B.
aurivella Batsch., W.
Flammula picrea Fr.
Naucoria badipes Pers.
escharoides Fr., T.
Agaricus xanthodermus Genev.

Hypholoma hydrophilum B.
Psathyra semivestita B and Br., C.
Cortinarius (Telamonia) flexipes Pers.
(Hydrocybe) obtusus Fr.
Lactarius aurantiacus Fl. Dan., T.
Russula rosacea Fr.
nitida Pers.
var cuprea Krom.
puellaris Fr.
Boletus crassus Mass.
castaneus Bull.
Fomes connatus Fr., W. and B.
Trametes serpens Fr.
Merulius molluscus Fr., T.
Porothelium Stevensoni B. & Br., C.
Solenia anomala Fr.
Hydnum viride Fr., B.
Caldesiella ferruginosa Sacc., C. & B.
Thelephora terrestris Ehrh., C. & B.
Lycoperdon excipuliforme Scop.
perlatum Pers.
Ptychogaster albus Fr.
Peziza sepiatra Cke.
Onygena equina P., W.
Tubulina cylindrica Rost.
Trichia fragilis Rost.
varia Rost.
Craterium confusum Mass.
Ceratiomyxa mucida Schröt = Ceratium hydnoides A. & S.

Résumé of the President's Address.

IT would be far beyond my grasp, even if time allowed, to enumerate, however briefly, the rapid progress that has been made in every direction in the study of Mycology during the past sixty years. It would not, perhaps, be stating too much to say that the entire amount of knowledge dealing with Fungi *as living organisms*, that we possess at the present day, has been acquired within that period. Among the pioneers in this branch of the study of Mycology the names of Berkeley, the brothers Tulasne, De Bary, and Brefeld stand pre-eminent. The two first named soon recognised that many among the numerous forms of fungi, previously considered as entities, were not so in reality, but were in many instances only phases in the life-cycle of a single species. Their method of endeavouring to prove the correctness of this new idea was by contiguity, or the constant sequence of forms having organic continuity; a condition of things now proved to be correct in many ascigerous fungi. As would be expected, in breaking new ground, slips were made; those minute fungi that in many instances are almost constantly present as parasites on certain other fungi, proved great stumbling-blocks. The next step, which in point of importance has no equal, was the introduction of the pure-culture method by De Bary. By this method the spores of a given fungus can be grown in a sterilised nutrient medium, and its gradual development followed step by step. Finally, Brefeld's brilliant discoveries are the outcome of a further development of De Bary's culture methods.

The following notes indicate very briefly some of the most important points elucidated by the above mentioned authors.

The Rev. Miles Joseph Berkeley, M.A., F.R.S., produced in 1836 his first work on Mycology (Eng. Flor., vol. v., pt. ii.), which so far as the larger fungi are concerned, is as yet unequalled for accuracy, simplicity of style, and originality; and although he continued to elucidate the systematic side of Mycology, as amply testified by his

magnificent herbarium, containing nearly 12,000 species, of which over 5,000 are type specimens, now deposited in the Kew Herbarium; it is probable that his name will, in the future, be more associated with the morphological and physiological side of Mycology than as a systematist.

The existence of basidia had been demonstrated before Berkeley's time, but in an important paper, entitled, "On the fructification of the Pileate and Clavate tribes of Hymenomycetous Fungi" (Ann. Nat. Hist., vol. 1, 1838), Berkeley was the first to clearly indicate that basidia, usually bearing four spores, were universal throughout the group. At this date the fructification of the Gasteromycetes was entirely unknown, save through some investigations made by Berkeley, which were communicated to Montagne, the celebrated French Cryptogamist. The latter, quick to appreciate their true value, translated Berkeley's correspondence, and it appeared under the title, "Sur la fructification des genres Lycoperdon, Phallus, et de quelques autres genres voisins" (Ann. Sci. Nat., Sept. 1839).

In this paper, accompanied by excellent figures, Berkeley demonstrated the fact that basidia, bearing the spores, are equally characteristic of Hymenomycetes and Gasteromycetes, and thus established the natural group entitled Basidiomycetes. Next appeared a very important paper, entitled, "Observations, Botanical and Physiological on the Potato murrain" (Journ. Hort. Soc., I., p. 9, 1846). Berkeley was for some time editor of the Journal of the Horticultural Society, and during this period numerous important papers on plant diseases emanated from his pen. This especial phase of Mycology was continued in after years in the pages of "The Gardeners' Chronicle," where scores of brilliant articles on plant diseases caused by fungi testify to his thorough grasp of the subject, and secure for Berkeley the great honour of being the founder of the important science known to-day as Vegetable Pathology. In conclusion, Berkeley's "Introduction to Cryptogamic Botany" (1857), although superseded at the present day, contains numerous suggestive paragraphs, which are much more frequently utilised than acknowledgments would indicate by writers at the present day.

Louis-René Tulasne, a member of the staff of the Natural History Museum, Paris, was a Mycologist of whom the French are justly proud. The following papers, selected at random from amongst numerous important contributions extending over a quarter of a century, suffice to indicate the calibre of mind possessed by the author. "Sur l'organisation et le mode de fructification des champignons de la tribes des Nidulariées" (Ann. Sci. Nat., 1844). This paper illustrates clearly for the first time the structure of the members consti-

tuting this interesting group. The author's brother, Dr. C. Tulasne, drew the very beautiful figures illustrating the paper. "Memoire sur l'ergot des glumacées" (Ann. Sci. Nat., 1853). The true life-history of ergot is worked out in detail; the minute conidia present on the surface of the sclerotium, previously considered as an independent fungus called *Sphacelia*, are shown to be merely the conidial or summer fruit of the ergot, the more highly evolved or ascigerous condition being produced from the sclerotium after a period of rest. Their last and most pretentious work, "Selecta Fungorum Carpologia" (1861-1865), in three volumes, folio, is illustrated by 61 plates, which, for exquisite beauty and detail and accuracy, have never been equalled. These volumes are entirely occupied with a detailed account of the morphology and life-history of the various groups of ascigerous fungi. The peculiar structures, termed pycnidia, spermogonia, conidia, &c., previously considered as independent species, were shown to be mere stages in the development of ascigerous forms. The remarkably interesting genus *Hypomyces* was worked out in great detail, the conidial stage of the species being in most cases indicated; such forms having previously been considered as independent species belonging to the Hyphomycetes.

Among the numerous brilliant discoveries made by Dr. Anton de Bary, each one of which would have placed any other individual in the front rank of Mycologists, it is not difficult to indicate the particular one which has led to the greatest results, namely, the introduction of the method of following the life-history of individuals by means of pure cultures. In 1864, De Bary commenced a series of beautifully illustrated monographs under the title "Beiträge zur Morphologie und Physiologie der Pilze," which were issued at intervals until 1882. In each of these new ground is broken, dealing with such subjects as the formation of the sporocarp in ascigerous fungi, and more especially with the sexual mode of reproduction in the Saprolegnieæ, Peronosporeæ, and Perisporiaceæ. The latter idea was elaborated in detail in the destructive parasite called *Sphærotheca Castagnei*, and although mercilessly assailed by Brefeld and others, has quite recently been corroborated in all essentials by Harper (Ber. Deutsch. Bot. Gesellsch., 1895). The discovery of Metoecism or Heteroecism in the Uredines swept away at one blow the numberless so-called species of *Aecidium* and *Uredo*, at the same time clearly indicating the method by which these form-genera could be relegated with their true affinities. In this country Dr. C. B. Plowright was the first to accept and work at the life-history of the Uredines from the standpoint of heteroecism, and I well remember the Friesian School of Mycologists, at the celebrated Woolhope Forays, expressing their deep regret at one of their number daring to depart from the beaten track of attempting—usually in vain—to make their spoils

agree with pictures and too brief descriptions. Finally, such names as Woronin, Karsten, Marshall Ward, Farlow, and Brefeld testify to De Bary's influence and success as a teacher.

Dr. Oskar Brefeld, who worked for some time under De Bary, has laboured continuously for the past quarter of a century in elucidating the life history of the fungi. Among his earliest investigations are those classic monographs on *Mucor mucedo* and *Penicillium*, where it it demonstrated that these are conidial forms alternating with morphologically higher spore bearing structures. The reproductive bodies of the conidial phase, in these and numerous similar instances, are produced in immense numbers, and in rapid succession, and are capable of germinating the moment they are mature, and serve the purpose of enabling the fungus to extend its area during the period favourable for its growth. This process of reproduction explains the rapidity with which fungous diseases spread after having once gained a foothold, especially where the host plant occurs in profusion, as in the case of cereals and other cultivated plants. On the other hand, the spores produced by the higher stage of the fungus require a period of rest before they are capable of germinating, and hence, tide the fungus over that period when conditions are not favourable for active growth.

In like manner numerous typical forms of every group of fungi were examined.

Brefeld's success in inducing spore-germination, and in growing pure cultures for long periods, thus demonstrating the varied forms assumed during different stages of development of the same species, has led to nothing short of a complete revolution of all previous ideas of affinity and classification. In the Basidiomycetes, where previous to Brefeld's researches conidial forms were considered to be very rare, these conditions are shown to abound. The peculiar spore-like bodies on the pileus of species of *Nyctalis*, previously considered as parasites belonging to a genus called *Asterophora*, were proved to be secondary reproductive bodies belonging to *Nyctalis*. The peculiar structures constituting the genus *Ptychogaster*, were in like manner proved to be the conidial forms of species of *Polyporus*. Perhaps the most brilliant of Brefeld's discoveries are embodied in his papers devoted to the life-history of members of the Ustilagineæ, which in addition to their great value as scientific contributions, are also of immense importance from an economic standpoint. Brefeld's researches are contained in twelve volumes, illustrated by numerous beautiful plates, commenced in 1872, under the title "Botanische untersuchungen über Schimmelpilze." In conclusion, it may be

stated that Brefeld denies the existence of a sexual mode of reproduction in the fungi, and is merciless in his attacks on all authors entertaining such an idea.

In England, only one person, Professor Marshall Ward, F.R.S., has consistently worked at Mycology along the lines I have endeavoured to indicate. During his residence in Ceylon, the life-history and morphology of *Hemileia vastatrix*, the terrible Coffee disease, were elaborated; and since his return to this country several very important works have appeared, including the classic entitled, "A Lily Disease," which exhibits an insight and grasp of the subject rarely equalled. Now that Professor Marshall Ward is located at Cambridge, the growth of a British school of Mycology is simply a matter of time.

BRITISH MYCOLOGY.

Under this heading it is proposed, in the first instance, to give descriptions of fungi added to the British list, since the cessation of the publication of "Grevillea." A start in this direction is now made, but space prevents the incorporation of all species recorded since the date above indicated. This list will be continued next year, and the co-operation of all Mycologists is solicited for the purpose of furnishing a complete record. In addition, notes relating to subjects dealing with the work of British Mycologists will find a place.

Lepiota leucothites Vitt., *Fung. Mang.* 310, pl. 40. Pileus globose, then expanding until almost plane, more or less umbonate, glabrous and silky at first, becoming broken up into squamules, especially near the margin, during expansion, white, sometimes with a tinge of brown or ochraceous at the disc, 5-10 cm. across; flesh rather thick, white, unchangeable. Gills free, but rather close to the stem, crowded, thin, rather broad, often wavy, white at first, becoming pale pink with age. Spores elliptical, smooth, hyaline, $9 \times 7\mu$. Stem, 7-12 cm. long, base bulbous, subcylindrical above, 1·5-2 cm. thick, differentiated from the flesh of the pileus, hollow, glabrous, white; ring large, white, persistent, superior.

On the ground. Herbarium Grounds, Kew; Isleworth, Surrey (G.M.); Malvern Hills (Rea).

Probably not uncommon, but hitherto confounded with *Lepiota holosericea* and *L. naucina*, from which it is readily distinguished by the rosy colour of the gills, this colour appearing deepest the day after collection. The figure in Cooke's Illustrations, pl. 524, called *Agaricus* (*Psalliota*) *cretaceus*, Fr., belongs to the present species.

Lepiota prominens Fries, Fr. Hym. Eur. 30 (=*Agaricus porrigens*, Viviani, Fung. Ital. pl. 12). Pileus globose then expanded, umbo large and subacute, disc covered with imbricated scales, the remainder

with scattered, adnate patches or scales of a brownish-ochre, surface between the scales paler, 6-10 cm. across; flesh rather thick, white, not changing colour when broken. Gills white, remote, narrowed behind, rather crowded, thin. Stem 10-18 cm. long, about 1 cm. thick, cylindrical from an abruptly bulbous base, slightly tinged brown or ochraceous, with a few scattered, darker adnate patches or squamules, white and glabrous above the superior, free ring, fistulose. Spores 10 × 7-8μ.

On the ground, Littlehampton (G.M.); Ledbury (Rea).

Closely allied to *Lepiota procera*, but distinguished by the very prominent subacute umbo, the pale stem with scattered patches of a darker colour, and the smaller spores. In *L. procera* the stem is brown with crowded, concentric, whitish cracks, caused by the rupture of the brown cuticle, which becomes rigid before the stem ceases to increase in length, and is consequently cracked in an irregularly concentric manner.

Omphalia Luffii Massee (sp. nov.). Pileus at first convex and more or less undulate, becoming depressed at the centre, extreme margin usually upturned, old ivory colour, white when dry, even, glabrous, 2-3 cm. across, flesh very thin, white; gills crowded, decurrent, thin, 2 mm. broad, pale wood colour, unchangeable; spores elliptical, hyaline, smooth, 5 × 3μ; stem 2-3 cm. long, 2 mm. thick at the base, thickened at the apex, often crooked, solid, outside glabrous, polished, coloured like the gills. Smell fragrant, spicy.

On the ground, gregarious. Guernsey (Luff).

Smell spicy, resembling that of *Clitocybe fragrans*, to which the present plant bears a superficial resemblance, but is readily distinguished by the short cartilaginous polished stem and other features noted above.

Clitopilus Sarnicus Massee (sp. nov.) Gregarious; pileus campanulate then expanding until quite plane, subumbonate, often more or less depressed round the umbo, slightly striate when moist, even when dry, mouse-colour, paler with a ruddy tinge when dry, minutely silky-flocculose, 2-3 cm. across; flesh very thin. Gills rather crowded, 3-4 mm. broad, plane nearly up to the stem, then suddenly decurrent, pinkish salmon-colour. Spores nodulose, with an apiculus, 7-8 × 6μ; cystidia absent. Stem 2-3 cm. long, 2 mm. thick, equal, slightly flexuous, even, white, glabrous, minutely, fistulose.

On the ground among grass. Guernsey (Marquand).

Allied to *Clitopilus undatus*, but differing in the slender, equal, white stem, and the absence of a grey tinge in the gills.

Pholiota sphaleromorpha Bull, Fr. Hym. Eur. 217, Sacc., Syll. vi., n. 3,057. Pileus convex then expanded, becoming plane or slightly depressed, margin often slightly wavy, even, yellow, 5-8 cm. across; flesh whitish, thickish at the disc, and becoming thin towards the margin. Gills slightly arcuately decurrent, rather broad, crowded, dry, pale dingy yellow, then yellowish-brown; spores obliquely elliptical, smooth, pale yellowish-brown, 10 × 7μ; cystidia subcylindrical. Stem 5-8 cm. long, about 2 cm. thick at the base, thinner upwards, stuffed, silky, coloured like the pileus below the distant, white ring, whitish above, flesh tawny.

On the ground. Queen's Cottage Grounds, Kew (Nicholson).

With somewhat the habit of *Pholiota præcox*, but altogether stouter, and with a yellow pileus and stem.

Hebeloma strophosum Fries, Fr. Hym. Eur. 240, *Sacc.*, Syll. vi., n. 3,320. Pileus convex then plane, with more or less of a suggestion of an umbo, rather viscid, bay, margin white and silky from the veil, 2-3 cm. across. Gills adnexed, eventually becoming almost free, crowded, ventricose, flesh colour then dingy cinnamon. Spores elliptic-oblong, smooth, pale cinnamon, 8-9 × 5μ, Stem 3-5 cm. long, 3 mm. thick, about equal, usually curved at the base, hollow, silky, whitish, tinged brown near the base, furnished with an imperfect, white, silky ring very near the apex.

On naked soil. Kew Gardens (Nicholson).

The only *Hebeloma* in which the partial veil forms a ring on the stem. This character at first sight suggests the genus *Flammula*, but the viscid pileus with a silky margin, along with other features, prove the plant to be a true *Hebeloma* belonging to the section *Indusiati*.

Agaricus rusiophyllus Lasch, Fr. Hym. Eur. 282. Pileus rather fleshy, convex then plane, slightly umbonate, fibrillose, pale flesh-colour, becoming pallid, 2-3 cm. broad; flesh whitish, unchangeable. Gill free, but not far distant from the stem, crowded, thin, dry, rosy then brownish. Spores obliquely elliptical, smooth, translucent brown with a purple tinge, 5 × 3μ. Stem 3-4 cm. long, 3-4 mm. thick at the incrassated base, thinner upwards, silky fibrillose, white, imperfectly hollow; ring persistent, drooping.

On the ground. Kew Gardens (G.M.)

A very beautiful little fungus, not closely allied to any other British species, most closely approaching *Agaricus comptulus* in size.

Stropharia æruginosa Curt. var. *squamulosa Massee.* (nov. var.) Pileus subglobose then expanded and slightly depressed, margin drooping, not at all umbonate, dry and silky from the first, soon becoming broken up into adpressed, silky scales, very deep verdigris-green, margin whitish, disc becoming ochraceous with age, 4-6 cm. across; flesh rather thin, white. Gills crowded, ventricose, thin, dry, sinuately adnate, brown, no tinge of purple, rather broad. Spores pale brown, elliptic-oblong, obliquely apiculate, 8-9 × 5μ. Stem 5-7 cm. long, 2 cm. thick, slightly constricted at the apex, hollow when old, paler green than the pileus, base white, flesh also tinged green, fibrillosely striate, clothed with white patches of the broken-up ring near the apex; fragments of the veil also frequently fringe the margin of the pileus.

On the ground among stones, &c. Ripon, Yorks. (Pratt); Louth, Linc., two seasons in succession (Larder); Kew.

A very distinct variety, will probably prove to be a good species; differing from *S. æruginosa* in the perfectly dry, silky, squamulose pileus, stout stem, and absence of purple tinge in the gills.

Coprinus roseotinctus Rea. (sp. nov.) Pileus membranaceus, at first cylindrical, 7-11 × 5-7 mm. fuscous, densely powdered with rose-coloured meal, silky, striate; at length revolute, umbonate, margin torn, sulcate along the back of the gills. Gills white, then black, adnexed, 1-1·5 mm. broad, deliquescent; cystidia not observed. Spores black, pip-shaped, slightly apiculate, 9-11 × 5-6μ. Stem at first short, then elongated, 5 cm. high, 2-3 mm. thick, base bulbous and white floccose, when young densely powdered with deep rose-coloured meal, only sparingly powdered near the apex at maturity, hollow from the first.

On the ground. Temple Laughern, Worcester, 8/97.

Characterised by the deep rose-coloured meal on the pileus and stem. Allied to *Coprinus niveus.*

Polystictus tomentosus Fries, Fr. Hym. Eur. 530. *Sacc.*, Syll. vi., n. 5535. Pileus plane, corky, becoming hard, often variously lobed and irregular, narrowed below into a short, stout, stemlike base, more or less triangular in section, solid, margin thin, straight; surface persistently tomentose or minutely velvety, tawny, margin sometimes yellowish, not zoned, 4-8 cm. across. Flesh pale tawny. Pores very minute, 4-5 mm. × 1 mm., mouth quite entire, rounded, greyish-yellow, at first delicately whitish pruinose. Spores elliptical, pale brown, 5 × 3μ.

On the ground. Guernsey (Marquand).

A very distinct species, allied to *Polystictus perennis*, but much stouter, and without a distinct stem; sometimes extending equally on every side from a central point, solid, pileus flat and not at all depressed; at other times spreading on the ground as an irregularly lobed body, from a central or excentric stout, stemlike, short base.

Bertia collapsa Rom., Bot. Notiser, 178, 1892. Perithecia usually densely gregarious, although sometimes scattered; seated on a brownish subiculum formed of branched, septate, intricately interwoven hyphæ about 6μ thick, obconic, upper surface slightly convex, densely but very minutely warted, with a central papilla, black, opaque, about $\frac{3}{4}$ mm. diameter, when old collapsing and becoming strongly concave above. Asci clavate, apex rounded, wall thin, 40-60 × 10-12μ; spores irregularly 2-3-seriate, elliptic-oblong, hyaline, smooth, 1-septate, 10-15 × 4-5μ. Paraphyses absent.

On dead stems of *Ribes rubra* and *R. Grossularia*. Guernsey (Marquand).

Forming dense black patches on the wood and bark. Hitherto only recorded from Sweden, where it grew on bark of *Pyrus Aucuparia*.

Verticillium Marquandii Massee. (sp. nov.) Patches broadly effused, minutely velvety, pale lilac at first, becoming deep lilac or amethyst coloured at maturity. Vegetative mycelium creeping, branched, septate, hyaline, slender, giving origin to numerous slender, erect, fertile branches, which are either simple, or usually with 1-4 short, alternate, or opposite branchlets, rarely in whorls of 3; tips of branchlets, also tip of main axis bearing a whorl of 3-6 flask-shaped conidiophores. Spores smooth, hyaline, lemon-shaped, solitary on the tips of the conidiophores, or rarely in chains of 2 conidia, 3-3·5 × 1·5-2μ.

Parasitic on the gills of *Hygrophorus virgineus*. Guernsey (Marquand). Common.

A very beautiful mould, and very conspicuous on account of its clear lilac colour. Numerous specimens were received during the months of October and November, 1897.

NOTES.

Professor Marshall Wards' opening address in Section K of the British Association, should be carefully studied by Mycological students, as amongst other subjects, it contains a summary, in chronological sequence, of the important discoveries that have raised the study of Mycology to the high standard it presents at the present day. The address is contained in "*Nature*," Sept. 9 and Sept. 16, 1897.

The "*Kew Bulletin*" for April, 1897, contains under the title, "Mycologic Flora of the Royal Gardens, Kew," an account of the fungi that have been collected in the grounds. These amount to 1,340 species, included in 337 genera. Some of these have certainly been introduced, as for instance *Aserŏe rubra*, *Chitonia rubriceps*, &c. On the other hand, truly indigenous species are also abundant; in the genus *Russula*, fifty-two, out of the sixty-one British species, have occurred in the gardens. Probably no other known area of equal dimensions—300 acres—has been shown to produce such a rich Mycologic Flora, even after the forty introduced species are deducted.

Little or nothing is recorded up to the present respecting the Mycology of the Channel Islands. During the past season, thanks to the intervention of Mr. E. D. Marquand, numerous consignments of Fungi have been forwarded to Kew for determination, from Guernsey. Over 500 species have been determined, several of which are new to Britain, and three, *Clitopilus Sarnicus*, Mass., *Verticillium Marquandii*, Mass., and *Omphalia Luffii*, Mass., are new to science. The preponderance of species belonging to the genus *Hygrophorus* is remarkable, and the Channel Islands must be considered as a new area, rich in species, and interesting as forming a link between the Mycologic Floras of England and France.

The form-species, *Botrytis Douglasii*, Tubeuf, must be added to the British list of destructive fungus parasites, young specimens of *Sequoia gigantea*, killed by this fungus, having been received at Kew for examination.

NOTES ON FOREIGN MYCOLOGICAL WORK.

Kawaschin has announced the interesting discovery (*Bot. Centralbl.* xliii, iii, 290) that the so-called microspores of species of *Sphagnum* are in reality the spores of a parasitic fungus developed in the capsules of the moss. This fungus is called *Tilletia Sphagni;* the spores are globose, clear brown, and covered with ridges combined to form a network of polygonal meshes; 11-12μ diameter. Careful search would probably result in adding this interesting fungus to the British Flora. It is said to be most frequent in species belonging to the *squarrosum* group of *Sphagnum.*

Révision des Champignons, *tant supérieurs qu' inférieurs, trouves jusqu'à ce jour dans Les Pays-Bas.* Dr. C. A. J. A. Oudemans.

The second part of this book is now before the public, and is undoubtedly, taken as a whole, by far the most important systematic work on Mycology that has appeared during recent times. The specific diagnoses are original and full, and the notes so frequently supplementing the specific diagnoses are of great value. Part I. (1893), contains the Hyménomycètes, Gastéromycètes, and Hypodermées. Part II. (1897), contains the Phycomycètes, and the Pyrenomycètes.

Monograph of the Laboulbeniaceae.

Dr. Rowland Thaxter has produced under the above title (*Mem. Amer. Acad.* XII., No. iii.), a charming volume illustrated by 26 plates, dealing with a branch of Mycology of which he may be truly said to be the founder, since the allied forms known previous to Dr. Thaxter's researches were very few in number, and imperfectly

understood. The Members of the Laboulbeniaceae are very minute, ascigerous fungi parasitic on insects. "When examined *in situ* on the host insect, they appear in general like minute, usually dark-coloured or yellowish bristles or bushy hairs projecting from its chitinous integument either singly or in pairs, more commonly scattered, but often densely crowded over certain areas on which they form a furry coating." A very remarkable feature of the group consists in the fact that the sexual organs are to say the least, analogous with those of the red sea-weeds or *Florideae*. There is a female organ or procarp, furnished with a trichogyne, and the fertilising or male organs resemble the antheridia. "The spores are produced in the asci in fours or eights, in the first instance usually disposed more or less definitely in pairs, one of which is slightly higher than the other; and the members of a given spore pair are discharged together. The juxta-position of two individuals at the point of contact with the host, a condition essential for the perpetuation of the dioecious species, is thus insured in the majority of cases." Many other features of extreme interest are to be found in the volume under consideration, but enough has probably been quoted to prove the importance of these minute fungi, and to arouse curiosity as to the attitude that will be assumed by Brefeld after the perusal of this work. The species are most abundant on Coleopterous insects, but are not confined to this group. Many of the species are quite abundant in the United States; 158 species, distributed among 30 genera are described. Not a single one is included in any British Mycological work, although in all probability, many species do exist in Britain.

Maladies des Plantes Agricoles *et des Arbres fruitiers et Forestiers causées par des parasites Végétaux.*

The two volumes of this work by Professor Ed. Prillieux, containing the life-history of every fungus known to be an injurious parasite to plants cultivated in Europe, and illustrated by numerous excellent figures, is undoubtedly the most complete and best in every way for the student of Vegetable Pathology.

Phalline.

Professor Kobert (*Lehrb. der* Intoxikationen, 1897. p. 457), has given the name of phalline to the poisonous substance present in *Amanita phalloides*, Fries. This substance is a toxalbumen,

and in its action produces symptoms similar to those occasioned by poisoning with phosphorus. Phalline is a very powerful agent, even in exceedingly minute proportions, in causing the dissolution of the red corpuscles of the blood; this is followed by the liberation of certain ferments which induce complex coagulation of the blood, and consequently serious cerebral disturbance follows. From ascertained cases observed in Russia and other European countries, it is shown that a very large percentage of the deaths due to fungus poisoning are caused by eating *Amanita phalloides*, Fr. The following species or forms also contain the same poisonous substance :— *Amanita virescens*, Flor. Dan.; *Amanita viridis*, Pers.; *Amanita citrina*, Schaeff.; *Amanita virosa*, Fr; *Amanita mappa*, Fr.; *Amanita recutita*, Fr.; and *Amanita porphyria*, Fr.

It is scarcely necessary to intimate, in face of the above statement, that in future one of the duties of every Mycological Society should be to impart to the general public a correct knowledge of the characteristics of the above named fungi and their deleterious properties.

M. Boudier has described and figured (*Bull. Soc. Myc. France* 1897, p. 10, pl. 1-3) several very interesting new French fungi, some of which may probably be found in Britain. The following brief diagnoses will indicate the leading features of these species :—

Pleurotus ostreatus, var. *nudipes*, Boud. Distinguished from the typical form by the perfectly glabrous stem.

Hygrophorus turundus, var. *lepidus*, Boud. Slender, 5-7 cm. high, pileus squamulose, and with the stem shining golden orange; gills deeply decurrent, pallid; spores 9-10 × 5-6μ.

Psathyra typhæ, var. *Iridis*, Boud. Slender, 2-4 cm. high. pileus fuscous, umbonate, striate, rugulose; stem paler with a floccose ring.

Ramaria Rieli, Boud. Robust, 10-12 cm. high, ochraceo-rufous, trunk thick, whitish, branches thick, robust, sparingly divided; spores pale ochraceous, smooth, 16-18 × 5-7μ; size and colour of *Clavaria formosa*, but distinguished by the much stouter, almost undivided branches.

Aleuria olivacea, Boud. Sessile, 3-5 cm. broad, entirely olive-fuscous, outside furfuraceo-granulose, spores elliptic-fusoid, verruculose, 22-23 × 10-11μ. Somewhat resembles *Peziza badia*, but distinguished by the spores.

Ascophanus (*Cubonia*) *dentatus*, Boud. Pale brown, the membranaceous margin broken up into triangular teeth; spores globose hyaline, 9-10μ.

Helotium fulvum, Boud. Stipitate, up to 0.5 mm. broad and high, tawny-brown, hymenium and base of pedicel darker; spores elliptic-oblong, hyaline. 16-21 × 7-10μ. Growing on mosses in the axils of the leaves.

Helotium cuniculi, Boud. Stipitate, 2-3 mm. broad and high, ochraceous-yellow, hymenium darker, and with a tawny margin; spores oblong-fusiform, becoming 1-septate, hyaline 16-20 × 6-7μ. On rabbit dung.

PHÆOMARASMIUS.

Under this name Von. A. Scherffel (*Hedwigia*, 1897, p. 288, figs. 1-3) has founded a new genus for the reception of species previously included in the genus *Marasmius*, Fries, characterised by having coloured spores, the colour ranging from yellow to ferruginous, whereas the species left in *Marasmius* must have hyaline spores. A new species, *P. excentricus*, having a sulcate, ferruginous, tomentose pileus 3-5 mm. across, and a short, excentric, curved stem is described. It occurred on living bark of *Pyrus communis*, in Hungary. Some of our British species will go into this genus. The above idea is in accordance with the arrangement adopted by Saccardo in the "Sylloge Fungorum," and has its advantages. The disadvantage is as follows:—*Marasmius* is a very natural genus, as defined by Fries, but split up as above, the white-spored section will be placed in the Leucosporæ, and next to *Collybia*, its nearest ally, whereas the coloured-spored section (*Phæomarasmius*) must be placed in the Ochrosporæ, miles away from the white-spored section, and near to *Galera*, with which it has not the slightest affinity. In a similar manner the genus *Russula* might be broken up into an emended *Russula* with white spores, and a new genus *Phæorussula*, characterised by having yellow or ochraceous spores, as follows—*Characteres generis Russulæ, sed sporis flavidis, ochraceis.* This genus would have to be located in the Ochrosporæ, where it has no affinities. The founding of genera on any *one* character is always objectionable, but the above

instances prove more than that. It is certainly a cheap bid for notoriety, which it secures, even if not of the kind desired by the author. Scherffel credits Fries as having founded the *Marasmius* with white spores, and himself takes the credit for *Phaeomarasmius;* but obviously this is illogical, neither of the genera as proposed by Scherffel correspond to the natural genus *Marasmius*, as conceived by Fries; both are founded by Scherffel, whose name must be written after every species by those who accept his arrangement.

EBENR. BAYLIS & SON, 22, CROSS AND TRINITY WORKS, WORCESTER.

The British Mycological Society.

(Recognosce notum, ignotum inspice.)

TRANSACTIONS

FOR THE

Season 1897-1898.

WORCESTER:

EBENR. BAYLIS & SON, STEAM PRINTERS, 22, THE CROSS,
AND TRINITY WORKS.

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THE DUBLIN FORAY.

HOWTH, POWERSCOURT, BRACKENSTOWN, BALLYARTHUR, LUCAN AND DUNRAN.

19-24*th September*, 1898.

The second annual week's fungus foray was held at *Dublin* under the auspices of the *Dublin* Naturalists' Field Club, and a right royal welcome was extended to the Society and its members by the *Dublin* Club. The botanical rooms in the Science and Art Museum, *Kildare Street*, *Dublin*, were kindly placed at their disposal by the Director, Colonel Plunkett, and the Keeper of the Herbarium, Professor T. Johnson, D.Sc., who spared no effort in arranging for the exhibition of the fungi from day to day collected, and procuring all books, microscopes, and other apparatus necessary for their determination.

Monday, the 19th of September, had been devoted in the programme to setting out and determining specimens sent in; but, owing to the drought that had prevailed for a long time, the members found there were scarcely any to deal with, and so a preliminary ramble was organized to *Howth*. Before starting Professor Johnson presented each member with a copy of "The fungi of the Counties of *Dublin* and *Wicklow*," by our member, Mr. Greenwood Pim, M.A., reprinted from the "Irish Naturalist" for August, 1898, and which enumerates over 830 species. *Howth* demesne proved to be a most suitable hunting ground, and nice specimens of *Hydnum udum* Fr., *Naucoria erinacea* Fr., and *Lepiota acutesquamosa* Weinm. were obtained, and an immature tuber was found, probably *Hydnotrya Tulasnei* B. & Br. In the evening Mr. R. Ll. Præger, M.R.I.A., President of the *Dublin* Naturalists' Field Club, received the members at the Botanical Laboratory, Royal College of Science, *Saint Stephen's Green*, and the naming of the specimens was at once proceeded with. Mr. Swann, F.L.S., exhibited a splendid series of photographs of the

Saprolegnieæ, which were of great interest, and contained at least one new to science.

On Tuesday, the 20th of September, *Powerscourt* demesne was visited, but only a few species of interest were collected, and these included *Polystictus Wynnei* B & Br. and *Marasmius Hudsoni* Pers. The Club dinner was held in the evening at Russell's Hotel, under the presidency of the Acting President, Mr. Charles B. Plowright, M.D., who subsequently delivered his presidential address in the Lecture Theatre of the Royal College of Science, entitled, "Notes and comments on the Agaricini of Great Britain" (see p 37).

On Wednesday, the 21st of September, the morning was spent in working at the herbarium and on determining the consignments of fungi which then came to hand from all parts of *Ireland* and from some parts of *England* as well. In the afternoon a search at *Brackenstown*, near *Swords*, was made, where *Hypocrea splendens* Ph. & Pl., *Rosellinia mammæformis* P., *Nolanea pisciodora* Cesati, *Poria vitræa* Pers. and *P. obducens* Pers. were found. At the evening meeting a very valuable paper was read on behalf of our member, Mr. Harold Wager, F.L.S., Inspector of Science to the Department of Science and Art, on "A fungus parasite on Euglena," wherein he recorded that the reproduction of *Polyphagus euglenæ* Schroet. is effected under normal conditions by the production of sporangia from the central or main portion of the organism. The nucleus and protoplasm pass into this sporangium, and the nucleus then divides first into two, then four, eight, sixteen and so on until about 128 nuclei are produced. Around each nucleus a small portion of the protoplasm collects; these masses become rounded off; each becomes surrounded by a membrane and thus 128 cells are formed, each of which is a spore. Each spore possesses a single cilium, and when the sporangium bursts the zoospores move away freely, and after a lively swim of about one hour or so, they settle down and soon develop into adult forms similar to the parent. This process of zoospore formation is completed in about 12 hours from the time when the sporangium commences to form on the parent cell. When the supply of healthy *euglenæ* begins to diminish owing to the repeated attacks of the parasite, the latter begins to produce its resting spores (zygospores or zygotes). These are produced as the result of a simple sexual fusion of the contents of two cells. A rhizoid from a somewhat small cell comes into contact with a large celled individual, and there swells up into a thick walled projection of a spherical form. The nucleus and protoplasm, both from the small cell and from the large cell, pass into this thick walled cell and there ultimately fuse together to form a uninucleate resting spore. This spore then remains in a quiescent state until again brought into a suitable environment when the thick

spore wall bursts; a sporangium is then put forth and zoospores are developed in exactly the same manner as in the asexual form. Dr. C. B. Plowright made some observations on "A clover-destroying fungus." The election of officers was then proceeded with, universal regret being expressed by all the members that their President, Mr. George Massee, F.L.S., was unable to attend the meeting. Dr. C. B. Plowright, was unanimously elected President, and Mr. Carleton Rea, B.C.L., M.A., elected Hon. Secretary and Treasurer. Mr. Rea, reported that he had enrolled 5 new members; 1 member, Mr. Nicholson, had resigned; and that the cash balance to their credit at the Post Office Savings Bank was £11 18s. 0d. An invitation from the Reverend Dr. Stevenson, on behalf of the Cryptogamic Society of Scotland, to join their meeting next year or the year after was then considered, and it was decided that as next year was the Scotch semi-jubilee, the year after would be more acceptable, and that the annual week's foray next year should be held in the *New Forest*.

On Thursday, the 22nd of September, the woods of *Ballyarthur* were explored and yielded specimens of *Boletus parasiticus* Bull., *Russula lepida* Fr., *Entoloma jubatum* Fr., and countless ascophores of *Chlorosplenium æruginosum* De Not. In the evening Dr. C. B. Plowright read a paper entitled "Recent observations of Professor Eriksson's on the rusts of our cereals" (see p. 76).

Friday morning, the 23rd of September, was devoted to work at the museum, and in the afternoon the demesne of Woodlands, near *Lucan*, was investigated, where fine specimens of *Amanita strobiliformis* Vitt., and *Cortinarius* (*Phlegmacium*) *fulgens* Fr. were gathered.

In the evening Mr. Greenwood Pim, M.A., exhibited some moulds under the microscope, including *Pimina parasitica* Grove, a full description of which is published at p. 65, and he also read a short note (see p. 65) concerning them. Dr. E. J. McWeeney made some observations on "Two sclerotia diseases of potato" (see p. 67). On behalf of the Rev. Dr. Keith, of *Forres*, examples were exhibited of *Puccinia ribis* D.C. on *Ribes rubrum* by Mr. H. T. Soppitt. This species has hitherto not been recorded for Britain, and had been met with at *Dallas*, *Elginshire*. Mr. Soppitt also showed the teleutospores of *Puccinia Pringsheimiana* Kleb. on *Carex Goodenowii* he had artificially produced from the well-known æcidiospores of *Æcidium grossulariæ* Gmelin, and presented the specimens to the *Dublin* Museum. Mr. C. Rea read a few notes on "The different names applied by English and French mycologists to one and the same basidiomycete." A very hearty vote of thanks was then unanimously voted to Professor

T. Johnson, D.Sc., for the great amount of trouble and labour that he had expended on behalf of the Society in selecting suitable places for the daily forays, personally conducting the members on their excursions, obtaining necessary permissions from landowners, arranging terms with the different railway companies and car drivers; in fact, the great success of the *Dublin* Foray was in great measure to be attributed to his untiring exertions To the Royal College of Science, the Museum authorities, the *Dublin* Naturalists' Field Club, and the owners of the different demesnes visited the best thanks of the Society were tendered for so kindly assisting them in every way.

Saturday, the 24th of September, was the concluding day of the week's foray, when the members visited the picturesque demesne of *Dunran*, by the kind invitation of Mr. Paterson, who subsequently most hospitably entertained them to luncheon. The demesne proved to be an excellent collecting ground, and was the dampest one visited during the week. *Boletus porphyrosporus* Fr. was found in some abundance, and a solitary example of *Hydnum cinereum* Bull., new to the British Fungus Flora, was obtained. Over 430 distinct species of fungi were identified during the week's foray, of which over 160 were additions to Mr. Greenwood Pim's list, and the most interesting are enumerated in the subjoined list.

LIST OF THE MORE UNCOMMON FUNGI OBSERVED DURING THE IRISH FORAYS 19th-24th SEPTEMBER, 1898.

Amanita porphyria Fr.
strobiliformis Vitt.
Lepiota sistrata Fr.
Tricholoma resplendens Fr.
inamoenum Fr.
Clitocybe fumosa Pers.
Collybia nitellina Fr.
clavus Linn.
Mycena Iris Berk.
acicula Schaeff.
amicta Fr.
pullata Berk & Cke.
Pleurotus subpalmatus Fr.
Eccilia griseorubella Lasch.
Inocybe eutheles B. & Br.
Naucoria erinacea Fr.
escharoides Fr.
Coprinus lagopus Fr.
Cortinarius (Phlegmacium) infractus Fr.
fulgens Fr.
(Dermocybe) cinnamomeus Fr. var. semisanguineus Fr.
(Hygrocybe) castaneus Bull.
Hygrophorus nitratus Pers.
Russula galochroa Fr.
Marasmius Hudsoni Pers.
Boletus parasiticus Bull.
aurantiporus Howse.
porphyrosporus Fr.
Polystictus Wynnei B. & Br.
Polyporus lentus Berk.
Poria vitrea Pers.
obducens Pers.
radula Fr.
Hydnum cinereum Bull.

Cyphella villosa Karst.
Pimii Phill.
dochmiospora B. & Br.
Puccinia hydrocotyles Link.
Melampsora epitea Kze & Schum.
Chætocladium Brefeldii Van T.
Peronospora urticæ De Bary.
Orbilia auricolor Sacc.
Ascobolus vinosus Berk.
atrofuscus Phil. & Plow.
Ascophanus carneus Boud.
Erinella juncicola Fckl.*
Lachnea hybrida Phil. var. lapidaria Cke.
dalmeniensis Phil.
Hydnotrya Tulasnei Berk & Br.
Nectria aquifolia Berk.
Ralfsii B. & Br.
dachrymella Nyl.
Eutypa Acharii Tul.
Nummularia Bulliardi Tul.
Hypocrea splendens Phil & Plow.

* A distinct species included by Massee, Vol. 4, p. 303 British Fungus Flora under E. apala, which is fawn colour outside, while this is quite white and much smaller in the ascophore but the spores are longer.— *Chas. Crossland.*

NOTES AND COMMENTS ON THE AGARICINI OF GREAT BRITAIN.

By Charles B. Plowright, M.D.

Presidential Address.

Ladies and Gentlemen,

I need hardly say how great an honour I esteem it to occupy the presidential chair this evening on the occasion of the visit of the British Mycological Society to *Dublin*.

Mycologists, if not a numerous body, are a very clannish one, and it seems to me that I am only meeting old friends. Our studies are beginning to be far more appreciated by our fellow-citizens than they once were, but after all we only constitute a very small section of the Army of Progress. One advantage of belonging to such a small corps is that we all know each other and that we are always certain of meeting with sympathy and kindness amongst our co-workers in whatever country we may happen to be—not only amongst English-speaking people, but in places where they do not speak English—at least, such has been my experience whenever I have been in *France*, in *Holland*, in *Sweden*, in *Denmark*, and in *Italy*.

It is sufficiently obvious that our Irish confreres are not behind-hand in the warm-heartedness of their reception of us. Needless to say we anticipate an exceptionally pleasant meeting, and that we hope to learn much from you.

Long presidential addresses are seldom interesting, dealing as a rule with generalisations; they lack the piquancy of concrete facts; generally they are too long, and being usually *post prandial*, they are commonly soporific. Deeply regretting my inability to give an address which shall be at the same time eloquent and interesting, I have to fall back upon the records of some thirty odd years of practical fieldwork amongst the larger fungi.

In the later half of the sixties, a few of us who devoted our attention—and I may truthfully say derived our greatest pleasure—from the study of fungi, began annually to meet at *Hereford* under the genial auspices of the Woolhope Club, impersonated in the energetic and kind-hearted secretary, the late Dr. H. G. Bull. We were but few in number, but we were full of enthusiasm. Messrs. Berkeley, Broome, Bull and Currey have joined the majority, but Worthington Smith, W. Phillips, M. C. Cooke, Howse, Spencer Perceval, Bucknall, Vize, and myself remain to look back with pleasant remembrances of our yearly gatherings in the cathedral city of the West of England. We soon found that to do any good with the larger fungi we must sketch them—otherwise what we learned one year we forgot the next. Many of us were skilful draughtsmen; but whether we were skilful draughtsmen or unskilful, we had to do our best, and we should as soon have thought of going to *Hereford* without our paint boxes as we should have thought of going without our hats. Now it was my misfortune not to belong to the skilful draughtsmen group, but for all that I had to do the best I could, and it is surprising how true the old adage proved—"Where there is a will there is a way"—for after a time I did succeed in producing sketches which the initiated were able to recognize, when the names were written with sufficient legibility beneath the species. We were all good friends; we had no petty jealousies: when a fungus was found at *Shrewsbury* it made its way to *Hereford*, to *Norfolk*, to *London*, to *Batheaston* and to *Sibbertoft*, and *vice versa*. As years rolled on, Dr. M. C. Cooke began to publish a series of coloured plates of the *British Agarics*, and although he personally up to that time had paid very little attention to this particular group of fungi, yet by his indomitable perseverance he managed to produce a figure of almost every British species. We all of us placed our sketches at his disposal. Now it is very curious how after a little practice one is able to catch the character of a fungus on paper; and so, although many of our sketches—at least mine were, I know—innocent of perspective, devoid of detail in the matter of shading, badly drawn and worse coloured, yet they formed the basis from which it was possible to construct very useful figures. The sketches of Mr. Worthington G. Smith W. Phillips, Dr. Bull, and C. Bucknall, do not, of course, belong to the same category. The point I wish to emphasize is this: that however rude a sketch may be, it has a definite value; and I would impress upon all those who attempt the study of the Hymenomycetes that they should make coloured outlines of any species that may be new to them. The trouble is not great, but the value, as these sketches accumulate, considerable. Those of us who have devoted any length of time to the study of these fungi, will not fail to have been struck by the difficulty of recognising species from descriptions,

and even with the aid of figures it is not always easy to be sure of your plant. We have all of us had for years the wrong plant in view with regard to certain species ; and it is only by such meetings as these that we get our errors corrected. Often, too, we have mistaken some rare species for a common one, and have had to climb down pretty considerably. The common species are the most difficult to recognize ; they are more prone to vary, and many of them devoid of marked characters.

In Dr. Cooke's "Illustrations of British Fungi" more than 1,000 species of Agarics are figured. No one who has had to do with the recognition of such a number of species can expect not to make some slips —it is impossible with such species as these Agarics not to fall into some errors. Those who have had to do with the publication of coloured figures know what a knack the figures have of not coming out the same colour as the copy. Hence, I venture to think that, if I can succeed in pointing out a few of the errors in these magnificent series of figures of Dr. Cooke's I shall be doing a service to those who have occasion to make use of them. Let me not be misunderstood, these criticisms are not offered in any captious spirit, nor in any way to disparage the laborious undertaking of the author but rather to increase the value of the work by correcting such errors as it lies in my power to do.

Let us begin with the Amanitae.

Amanita pantherina D. C. There are two distinct fungi confounded under this name. They are neither of them very common in this country. One of them is figured by Paulet t. 162, f. 2, and doubtless figures 1 and 3 on the same plate are also intended for it. It is a more slender plant than the other, having a dark brown or umber brown pellicle which has but little tendency to become pale, with small persistent white warts.

The other species is figured by Krombholz t. 29, f. 10 to 13, Schaeffer t. 90 and Paulet t. 161. This is a much stouter fungus with a thicker stem, and not so distinctly white warts which are usually larger. The pellicle is paler but more umber than brown and decolourizes rapidly with age. The character common to both and to which Fries attached so much importance is the adnate ocreate volva with an obtuse edge. In our early days many of us fell into the error of expecting an ocreate volva to show signs of an ochre colour just as roseate implies a rose colour. I need hardly tell you that ocreate is a botanical term implying that the volva embraces the stem as a stocking does the leg. In Cooke's "Handbook of

British Fungi" *Amanita pantherina* is said on the authority of Mr. Worthington G. Smith to be " not poisonous," but however fungus proof Mr. Smith himself may have been when he wrote this since then it has caused so many deaths in France and Germany that it ranks between *A. phalloides* and *A. muscaria* as one of the most lethal species. It is the first of these forms which Cooke Ill. pl. 6 probably represents.

Amanita strobiliformis Vitt. is a very uncommon species represented in the "Illustrations" pl. 8 by a fungus with a dark reddish brown cuticle from a figure of Dr. Bull's: this however is quite wrong, and was corrected by the issue of a second figure plate 277, which shows a group of three said to have been found at *King's Lynn*. This, however, is a mistake. I never found but a single specimen that was in 1871 on *Ringstead Downs:* it was solitary, fully expanded and flat on the top, but the warts were quite distinctive being large angular, persistent and mouse grey.

Amanitopsis vaginata Roze. Fries in the "Monographia" points out that Persoon divides this into two species (*livida and spadicea*). Schaeffer makes four of it and Secretan ten: so that he himself thinks the wisest plan is to group all forms under one. Whatever grounds the above authors may have had for so much sub-division yet I think the two common forms the grey and the brown (*livida and spadicea*) have fair grounds for specific rank. Not only, as the master himself points out, does one appear earlier in the season than the other but also there are certain distinctive characters in the volva. In both one may often observe, as Dr. Stevenson says in "British Fungi," vol. 1, p. 11, that the ring though obsolete is present more or less conspicuously at the base of the stem enclosed in the volva: but more than this as my esteemed friend, the Rev. Dr. Keith, whose practical knowledge of the Hymenomycetes of his own country is unsurpassed, pointed out to me in the reddish brown form (*spadicea*) there is a second volva inside the outer. In the grey form (*livida*) there are folds or wrinkles of considerable size on the inner surface of the volva.

Amanitopsis adnata W.G.S. is an Amanita which seems to be getting more common than when it was first recognised by Mr. Smith from specimens from *Somersetshire* in 1871. It is well figured in Saunders and Smith's "Mycological Illustrations" t. 20 as a ringless species. Five years later Dr. Quélet described and figured (Bull. Soc. Bot. de *France*, 1876, t. iii. f. 10) under the name of *A. junquillea*, a very similar fungus but with a ring. Last year I

gathered Quélet's species near *Paris* during the excursion of the Societé Mycologique, and on my return I found near *King's Lynn A. adnata* in a new habitat where I had ample opportunity of examining it carefully. One of the first points noticed was that some specimens had a ring while others had not so that it is evident these two species are identical but Mr. Smith's name has the priority.

Lepiota Vittadinii Fr. Another rare fungus which has never appeared at any of the fungus shows I have been at. I have found it but once when it was growing in some long grass in an unused gateway by a road side. Many of the warts had fallen off of themselves and laid upon the ground beneath and around the fungus. The figure in the Illustrations t. 36 is after Krombholz t. 27 and a better one cannot be.

Tricholoma equestre Linn. is a fungus rarely found in England but one of great beauty which ornaments the pine woods of Scotland to a limited extent, being of a brilliant yellow beneath, brighter even than *T. sulphureum.* The colouration of pl. 72 is as much too pale as that of the next species *T. sejunctum* t. 53 is too bright.

Tricholoma portentosum Fr. Pl. 54, is from a sketch of Mr. James Renny, I believe everybody admits that the plant figured is *Collybia platyphylla* and not *portentosum* at all.

Tricholoma acerbum Fr. Pl. 76 shows the character of the plant but is much too dark in colour.

Tricholoma flavo-brunneum Fr. Pl. 58 is not a typical figure if it be one of the plant at all. The stem is too stout and there is no trace of yellow about the gills which is distinctive of the true plant.

Tricholoma vaccinum P. Pl. 60 again is not so good a figure as it might have been. The true plant has a thinner stem and while the scales on the pileus are less numerous than those in the sketch they are larger. It was originally published as a figure of *Trich. imbricatum* but the author corrected the name.

Tricholoma immundum Berk. Pl. 61 probably from Berkeley's original figure is another uncommon species. I have met with it in two localities near King's Lynn, and M. Boudier showed it to me last year in the Forest of Compeigne. It may always be known by its pale stone colour and by turning first dark blue and then black when bruised.

Tricholoma virgatum Fr. Pl. 167, is I believe from a figure of mine made in August 1883. The great character is the striæ on the pileus but these are not nearly so pronounced as the plate would lead one to suppose.

Tricholoma inamœnum Fr. Pl. 77 has generally a tinge of buff colour and is not so elongated a plant.

Clitocybe rivulosa Fr. Pl. 200 and its variety *neptunea* Batsch. This is a very common fungus amongst short grass especially on road sides, but it is one over which we all came to grief and it is only through the kindness of M. Boudier that we were set right. In Fries "Hymenomycetes" the sub-division Disciformes of the Clitocybe is split up into five groups: in the fourth of which Cl. rivulosa is placed. This group is characterized as "Pileo viridi, pallescente," now it so happens that *Cl. rivulosa* has no trace of green about it anywhere. The subsequent writers (Stevenson, Cooke and Massee) have simply copied and re-copied the error hence in our attempts to make out the fungus from our English handbooks we have always passed over the group which contained the description of *Cl. rivulosa*. Various names have been suggested for the plant in question—*e. g. A. dealbatus*, *gallinaceus*, *obsoletus*, *diatretus*, *&c.*, but there is no doubt that *Cl. rivulosa* is the fungus Fries originally had in view. It is a small whitish species which in wet weather looks as if it had a coat of white varnish and it is the cracking of this coat in a rivulose manner which gives the fungus its name. When growing and well grown it has a very pale flesh coloured tint, but this is not observable on every specimen: with age it becomes light in colour and distorted in form. I am by no means sure that Hussey t. 39, lower figure is not intended for a sodden condition of this plant: the upper figures of Cooke "Illus." pl. 104 (*A. dealbatus*) is probably also the same thing although the stem is rather stout.

Clitocybe maxima Fr. and *gigantea* Sow. are two frequently confounded species, and although they have in common the character of magnitude they are otherwise abundantly distinct. It may facilitate the remembrance of their individuality to recall the fact that Fries in the "Monographia" classes *A. giganteus* with the *Lepistæ*. It is not only very large but it is infundibuliform with crowded gills and a short stout stem an inch and a half or two inches long and nearly as much thick. Cooke's figures in the "Illustrations" 135 appear to be *Clitocybe geotropa*.

Clitocybe flaccida Fr. and *inversa* Scop. are I believe indis-

tinguishable, unless one decides by colour alone taking *inversa* to be the brick red and *flaccida* the yellowish brown plant.

Clitocybe Sadleri Berk. (Cooke "Illus" pl. 127) is nothing but a distorted form of *H. fasciculare* as its cæspitose habit, its colour and its acrid bitter taste show. It is one of the peculiarities of *H. fasciculare* that it often fails to produce spores on its hymenium so that the gills remain sulphur yellow. One or two such specimens generally turn up at each fungus show. I have several times seen it in this condition at *Hereford*, as well as at *Selby* and *Worksop*. It does not seem that the spores are deficient in colour, but that they are not produced at all.

There are three *Collybiæ* either growing upon fir cones or under fir trees, both Spruce and Scotch, which are very difficult to differentiate, viz. *Collybia tenacella* Jacq., *esculenta* Pers., and *conigena* Pers. They are all common, and occur all the year round; but personally I must admit my inability to discriminate them and would recommend their special study to the members of the Mycological Society. It may be that they are three good species, or it may be that there are only two.

Mycena Iris Berk. a by no means uncommon, but frequently overlooked Mycena, since the blue fibrillæ disappear almost as soon as the plant is above the ground level. They are seen to the best advantage on those young specimens which are coming up amongst fir needles. If a handful of the loose needles be gathered in which a very ordinary looking pale brownish Mycena is growing, and the bases of the stems examined, young plants with the blue fibrillæ may generally be found. There is no really good figure of this fungus: Berkeley's "Outlines," t. 6 fig. 3 is perhaps the best. Cooke Ill. plate 161, lower fig., is from Berkeley's original sketch. Bresadola's *Mycena calorhiza*, t. 5 fig. 1, is the same plant.

This last named plate is grotesquely over-coloured, an error into which those who paint fungi with water colours do not generally fall. This mistake is usually in the opposite direction—not getting the tint dark enough. There are two pink-spored species which it is hardly possible to depict in sufficiently brilliant colours, viz., *Pluteus leoninus* Schaeff. and *Leptonia euchroa* Pers. The figures in the "Illustrations" (421 and 334) convey but a very inadequate idea of the brightness of the colouration, either of the orange or of the blue; and if you try to figure them yourselves you will find that your colour box does not contain pigments of sufficient brightness.

On plate 422 of the "Illustrations" a curious but not rare form of *Pleurotus subpalmatus* Fr., is depicted under the name of *Pluteus phlebophorus* var. *reticulatus* Cke.

Pholiota caperata Pers. a firwood species found hardly anywhere else than in Scotland, I believe. The plant figured in the "Illustrations" 348 under this name is from a sketch of Mr. Phillips of *Pholiota aurea*, which he made from a specimen we found in company with Rev. Dr. Stevenson on 24 September, 1886, at the *Den of Airlie*. The stoutness of the veil which was covered beneath with brown furfuraceous scales was very distinct. *Ph. caperata* has a membranous veil, it is a much more tender plant; in fact, in the "Epicrisis" and "Monographia," Fries places it amongst the larger *Cortinarii* but in the "Hymenomycetes" he puts it back again amongst the *Pholiotæ*.

Pholiota comosa Fr. pl. 600 and *P. heteroclita* Fr. pl. 366, are two excellent figures of the same plant as is now pretty generally admitted by Mycologists. The first name has the priority.

Pholiota flammans Fr. pl. 368 is taken from a figure the late Dr. Bull made from specimens I sent him from *Dunoon* in August 1872. Oddly enough, the main character of the plant is entirely missed, viz., the sulphur yellow scales on the pileus, which are *paler* than the cuticle.

Pholiota Cookei Fr. pl. 354 and *Ph. terrigena* Fr. pl. 349 are two Friesian species, but they are really identical.

Flammula astragalina Fr. pl. 435 shows no change of colour on injury as it should do: this is a point made the most of generally in sketches of fungi.*

Hebeloma testaceum Batsch. f. 198 is a well-marked variety of *H. crustuliniforme* Bull, which is entitled to rank as a species. It is easily recognized by its distinctly bulbous stem, and is pretty common in fir woods and heathy places during October and November.

Stropharia Percevalii B. and Br. Ill. pl. 550, is only a form of *St. depilata* Pers. The former has a hollow stem while the latter has a solid one. In the year 1888 I gathered at *Floda* near *Gottenburg*, in company with Dr. Fries a series of specimens of

* Mr. George Massee refers this plate to *F. rubicundula* Rea (see Grevillea vol. 22 p. 40, pl. 185).

St. depilata, which were sketched at the time. The sketches show that *depilata* has somtimes a distinctly hollow stem.

Hypholoma lacrymabundum Fr. is a species which has proved a terrible stumbling block to British Mycologists. It is not a very common species and what generally goes by the name *lacrymabundum* is the next species *H. velutinum*. Messrs. Berkeley, Broome, Smith, Cooke, Phillips, and myself have all come hopelessly to grief about it. For some reason or other Mr. Berkeley named some specimens exhibited at *South Kensington* in 1873 as well as others from *Coed coch* and *Ascot*, *A. storea* regardless of the fact that they were densely cæspitose while *storea* is always solitary. We all of us followed Berkeley without hesitation until the publication of "Fries Icones" when the Rev. Dr. Keith immediately recognised our so-called *storea* to be the true *lacrymabundum*. In 1888 I showed specimens to Dr. Robert Fries, of *Gottenburg*, who unhesitatingly pronounced them to be *H. lacrymabundum*. So deeply has the name *storea* got hold of the English mind that Mr. W. G. Smith in looking over some sketches of mine three years ago marked one of this plant *H. storea*. The figure in the Illustration 543 is *H. lacrymabundum* as is also *A. hypoxanthus Ph. and Pl.*

Cortinarius (Phlegmacium) triumphans Fr. One of the best figures in Cooke's "Illustrations" is pl. 703 from one of Dr. Bull's sketches. It is a well known plant but by a curious accident is wrongly referred to *C. saginus*—an accident which arose from no fault of the author. In 1888 I gathered the fungus figured near *Gottenburg* with Fries's son, Dr. Robert Fries, who unhesitatingly pronounced it *C. triumphans*.

Cortinarius (Telamonia) torvus Fr. pl. 801 and *C. impennis* Fr. Ill. 853, differ only in the larvae tracks in the stem. This fungus whichever species this may eventually prove is very common round *Hereford* and elsewhere in *England*. It has nothing to do with the plant the *French* Mycologists regard as *C. torvus* nor do Fries' figures in the "Icones" help us.

Lactarius exsuccus Smith. This fungus is well known in this country, and was at one time regarded as a variety of *L. vellereus*. Mycologists in *France* as well as in *Sweden*, however, do not consider this to be a *Lactarius* at all but the *Russula delica* of Fries.

Lactarius theiogalus Fr. This is a common *Lactarius* but one which is easily overlooked. There is no good figure of it. It is a

fir wood species often found amongst heather at the margins of fir woods. Sometimes one can trace the attachment of the base of the stem to last year's dead stumps of Pteris aquilina stems but not always. In colour it is one of the red brown group resembling *L quietus*, *subdulcis*, *serifluus*, etc. It differs mainly, however, in having when young a suggestion of liver colour, in the gills being rather distant and the margin of the pileus crenulate. It is very hygrophanous becoming when dry pale brown. The great character is in the milk, which is white and which remains white for some considerable time but it eventually becomes pale sulphur yellow. Here again I am indebted to my esteemed friend M. Boudier. The figures quoted by Fries as being those of *L. theiogalus*, namely—Bolton, t. 9, Krombholz t. 1 f. 23 and 24, and Bulliard t. 567 f. 2, may be of anything. M. Boudier, however, thinks the figures of Bulliard are *L. chrysorrhæus*. The best figure of *L. chrysorrhæus* is in Cooke's "Illustrations" pl. 984.

Lactarius helvus Fr. A common species commonly mistaken for an old *L. torminosus*. I am informed by his son that Fries attached no special meaning to the word *helvus* beyond yellow. Cooke's Ill. pl. 974 is typical *L. helvus*, but pl. 994 certainly is not.

Marasmius urens Fr. Cooke Ill. pl. 1,116 is far too dark on the pileus the real plant being more the hue of M. oreades. "Berk. Outlines" t. 14 f. 3 is a much better figure. It is an uncommon plant. I never have met with it but once and that was at *Mattishall*, *Norfolk*, the former residence of the Rev. Canon Du Port.

Marasmius cauticinalis With. is a beautiful yellow fungus which for a few years grew abundantly on *Merryhill Common* near *Hereford*, under some Scotch fir trees. I have never seen it before nor since. The figure in the Ill. pl. 1,134 is much too dark on the pileus.

It is, however, high time to stop, when one has devoted upwards of thirty years to the study of any particular subject and gets a chance of talking about it he is apt to become wearisome.

A POTATO DISEASE.

By H. Marshall Ward, *D.Sc., F.R.S., Professor of Botany in the University of Cambridge.**

I have for some time past had occasion to recognise here and there, in various parts of *England*, a potato disease which is not due to *Phytophthora*, and which has often been ascribed to bacteria. During the past two years my attention has been especially directed to testing its bacterial origin, and I am convinced it is not due to bacteria, but to a true hyphomycetous fungus.

Without going so far as to say there is no bacterial disease of the potato, I wish to express the conviction that the alleged cases of such lately published are not convincing, and that a tendency exists to draw conclusions from imperfect evidence.

I shall show that the way into the tuber is prepared for bacteria by fungus hyphæ, and the open passages of destroyed vascular bundles afford them ample space. The disease I have studied has appeared in a more or less epidemic form at least twice in my experience : it was very common two years ago, and this year has been abundant in various parts of *England*. In a subsequent publication I shall show that it is common and wide-spread, and even known in some countries, though not adequately recognised.

Symptoms.—The shoots turn yellow and die prematurely during the summer, and before the tubers are anything like full. The disease *starts from below* and *not from the leaves*. The roots are few and poor, and soon rot away. The tubers are few, do not mature, and often rot in the ground. The leaves turn yellow and wither on the stems, with the symptoms of *premature wilting*, and often remain long hanging on the yellowing, glassy-looking, but still living stems.

In very mild cases these symptoms are not obvious, and supervene

*Reprinted from Abstract of papers read at the British Association Meeting, 1898.

slowly, and the case may be complicated by the co-existence of *Phytophthora*. In very severe cases, on the other hand, especially in wet situations, the stems and roots may be all rotten by the end of July, and casual observation may ascribe the damage to *Phytophthora* entirely. In ordinary cases, again, it is easy to suppose the damage due to some insect attack, or to drought.

In advanced stages of the disease the stems either dry up to brown sticks, or putrefy on the wet ground; very often bacteria have gained access to the tissues at a comparatively early stage.

Microscopic Appearances.—Sections across the lower parts of the attacked stems show one, two, or more of the vascular bundles yellowish-brown—visible even without a lens—and the principal vessels of these contain branched, septate hyphæ. In several cases I have traced these hyphæ through every internode of the stem, into the petioles of the still hanging leaves, into the young lateral shoots, throughout the roots and subterranean rhizomes, and *up to and even just into the tubers*. In two cases I have done this in one and the same potato-plant, and so have no longer any hesitation in ascribing the disease to this fungus, the morphological features of which will be described in a subsequent paper. In advanced cases the brown vessels are stopped with a yellowish gum-like substance. Tyloses are common in the vessels of the root. Those tubers which are not attacked while still very young, but which have already begun to fill with starch, may offer considerable resistance to the invasion of the fungus; bnt eventually the vascular strands diverging from the point of attachment to the rhizome exhibit the tell-tale foxy-red or yellowish-brown colour, and in many cases the ripened tubers are to all appearance sound, except for *microscopic reddish spots just at the points of entry of these bundles.*

During the winter the stored potatoes, with the fungus thus just lurking in them at the morphological base (the so-called heel) of the tuber, may undergo little change to all appearance if *gathered and stored dry*.

But, if wet, various kinds of rot may supervene, owing to the *subsequent invasion* of various micrococci, bacteria, fungi, &c., following the lines of weakness opened up by the fungus in question, and living as saprophytes on the stored reserves.

In some cases even apparently dry tubers may undergo a curious rot—dry-rot—owing to the ravages of a particular bacterium or mould, perhaps more than one, which finds sufficient moisture for its purposes.

The principal point is that the fungus I have especially studied leads the way for these purely saprophytic anaërobic and aërobic forms into the tuber: once in the mature tuber, its progress is necessarily slow until the reserves move in the spring.

During the past winter I gave to Miss Dawson, who is working at such subjects in my laboratory, some of the tubers saved from plants attacked with this disease, to investigate the various fungal forms lurking in the diseased tubers. Her investigations are not yet completed, but enough has been accomplished to convince us that after the fungus in question has opened up the way into the tuber, all sorts of bacteria and fungi can make their way down the destroyed vascular strands, and reappear in spring, when the tubers are replanted.

But this is not all. The evidence shows that the fungus in question, once in the tuber, leads a dormant life during the early part of the winter, but gradually invades the new sprouts as they slowly appear in the early spring, and that *the parasite is actually replanted* by the farmer or gardener, when restocking the ground, *in his new "sets."*

If we reflect that the tuber is really a bud, there is nothing especially strange in this phenomenon; the fungus enters the base of the bud in autumn, and takes some months to traverse its dormant tissues during the winter and spring. A spotted tuber may give rise to some healthy and some diseased sprouts, according to the tracks of the fungus.

A curious phenomenon was observed in some potato plants very badly attacked by this disease this summer. In some of the badly diseased young shoots quantities of beautifully developed *cubical proteid crystals* (crystalloids) were observed in the parenchyma of the pith and cortex. It is due to Mr. W. G. P. Ellis to point out that he was the first to see these in some sections he was kindly cutting for me of this batch of specimens. On going further into the matter I find such crystalloids have been seen by Heinricher in the shoots of a diseased potato (1), but he did not give any account of the disease itself.

I find these crystals are not uncommon in the still green bases of the petioles of the withered leaves hanging on the diseased shoots, though they do not always occur.

I ascribe their formation to the accumulation of proteids in the

(1) Ber. d. deutsch. bot. Ges. 1891.

leaves, while still living and active, from which the passages of transference at the nodes of the stem have been cut off by the fungus; just as the eventual withering of the leaves is due to the blocking of their water conduits when all the vessels are stopped up.

At the same time, the attempts I have made to induce the formation of these crystalloids artificially have failed so far.

Neither ringing, nor ringing combined with destruction of the pith with a hot skewer—to destroy the internal phloëm—has given satisfactory results as yet, though the leaves of healthy plants withstand this drastic procedure much better than might be supposed.

Here again I must reserve further particulars for the fuller paper.

In conclusion, it is evident that the efforts of the potato-grower must be directed to the selection of sound sets, and to the careful preparation of his ground. I hope to show later that it is a fatal procedure, even with sound sprouts, to allow the young shoots to lie in contact with raw manures, as it is *viâ* wounds and small rotting spots at and near the collar that new infections occur. The same arguments apply to wet soils and situations, and the disease is particularly apt to increase when wet and cold weather supervenes on the early growths.

PENICILLIUM AS A WOOD-DESTROYING FUNGUS.

By H. Marshall Ward, *D.Sc., F.R.S., Professor of Botany in the University of Cambridge.**

Spores from pure cultures of *penicillium* were sown on sterilised blocks of spruce-wood, cut in March, and were found to grow freely and develop large crops of spores on normal conidiophores. Sections of the infected wood showed that the hyphæ of the mould entered the starch-bearing cells of the medullary rays of the sap-wood and consumed the whole of the starch. The resin was untouched. In culture three months old the hyphæ were to be seen deep in the substance of the wood passing from tracheid to tracheid *viâ* the bordered pits. Control sections, not infected and kept side by side with the above, contained abundance of starch, and no trace of hyphæ could be detected in them.

The observation appears of interest in several connections. *Penicillium* is one of our commonest moulds, and undoubtedly plays a part in the reduction of plant *débris* to soil-constituents; how far it can itself initiate the destruction of true wood, or how far it merely follows on the ravages of other fungi, bacteria, &c., is unknown. There are strong grounds for believing that it destroys the oak of casks, &c., but since these are impregnated with food-materials, this is not very surprising. Trabut[1] has shown that *penicillium* will grow in solutions containing 2-9·5 per cent. of $CuSO_4$, and other evidence exists showing how remarkably resistant this mould is, and how little organic matter it needs for life.

Dubois[2] showed that *penicillium*, or a closely-allied form, not only lives in strong solutions of copper, neutralised with ammonia, but will erode metallic copper and bronze if transplanted thereon.

Iönssen[3] found *penicillium* living in one-tenth normal sulphuric acid solution, and gives some interesting facts regarding the sulphur-containing oil-drops in its protoplasm, and other statements concerning oil in this fungus occur in the works of De Bary, Brefeld, Pfeffer, &c.

Gerard[4] gives proof that *penicillium* can liberate butyric acid from monobutyrine, and evidence that this it due to its power of forming a *lipase* or fat-splitting enzyme.

Lesage[5] gives striking instances of the resistance to external influences shown by the spores on germination. Not only will they germinate and live for some time in water, and under almost anærobic conditions, but he found them germinating in 26·5 per cent. solutions of common salt; 30 per cent. solutions were too much for them, however. He states also that the vapour of cedar-oil, iodoform, napthalin, camphor, and patchouli do not prevent germination; though that of clove-oil, ether, alcohol, chloroform, and acetic acid prevent it. The maximum for alcohol was somewhere between 4·2 and 6·2 per cent. In acetic acid they germinated in twenty-four days in solutions of 1 : 256, but failed to do so in solutions of 1 : 64, whereas in HCl. they germinated in two days in 1 : 4 solutions.

As regards temperatures, it is well known how resistant the spores are; a striking instance of the hardships the mycelium can undergo is given by Woronin.[6] He found *penicillium* vegetating on the melting snow, where the temperature at night fell below 0° C.

Bourquelot[7] found Invertase, Maltase, Trehalase, Emulsin, Inulase, Diastase, and Trypsin in the allied *aspergillus*, and pointed out how suggestive this is in explaining the ubiquity of this mould. Probably *penicillium* is equally rich in capacity for enzyme-production.

Miyoshi[8] showed that *penicillium* can bore through cellulose membranes, and no doubt similar chemotactic phenomena are concerned in the piercing of wood-elements by the hyphæ.

It certainly looks as if *penicillium* may be a much more active organism in initiating and carrying on the destruction of wood than has hitherto been supposed, and that it is not merely a hanger-on or follower of more powerful wood-destroying fungi. It is also, doubtless, very independent of antiseptics.

* Reprinted from Abstract of papers read at the British Association Meeting, 1898.

[1] *Bull. de la Soc. Bot. de Fr.*, xlii., 1895, 1,
[2] *Comp. Rend.*, 1890, cxi., p. 655.
[3] *Bot- Centr.*, xxxvii., 1889, p. 201.
[4] *Bull. de la Soc. Mycol. de Fr.*, xiii., 1897, p. 182.
[5] *Ann. des Sc., Nat.*, Ser. 8, T. 1, 1895, p. 309.
[6] *Arb. d. St. Petersb. Naturf. Ver.*, B. xx., p. 31.
[7] *Bull. Soc. Mycol.*, 1893, p. 231.
[8] *Bott. Zeit.*, 1894, H. 1.

NEW AND RARE BRITISH FUNGI.

By Charles B. Plowright, M.D.

Continued from Grevillea, Vol. xiii., p. 73.

In June, 1874, the first of a series of papers bearing the above title appeared in "Grevillea" by Mr. W. Phillips and myself. They were continued from time to time as material for them accumulated until that periodical ceased to exist. Their object was not simply the ennumeration of species new to the British Flora, but also the record of new localities for rare species, as well as reference to any other point of interest connected with them. Since the first of the series was published the study of Mycology has undergone great change: facts which were then keenly disputed have long since been accepted without demur, arrangements and nomenclature then in vogue have become antiquated. More attention is now paid to the biological aspect of the question than to the morphogical; but to us the study of this group of plants still retains its fascination, and we hope from time to time to continue the publication of these papers.

297. *Mycena farrea* Lasch. Pileus membranaceous, campanulate, then expanded, subumbonate, sulcate, covered with a shining pruina, becoming pale, margin crenulate, stem slightly rooting, silky striate, gills adnate, thin, connected by veins, rather fimbriate, white.

Fries "Hymenomycetes Europæi" p. 134. "Icones" t. 79 f. 4.
North Wootton Heath, 24th September, 1897.
Amongst moss and heather.

Fragile, stem 2-3 inches long, pileus whitish or yellowish, often with a tinge of flesh colour, about 1·5 cm. ($\frac{1}{2}$ an inch) across, at first with a floccose margin. It is easily recognised by its white pruinose appearance, which is due to the superficial cells of the pileus being dilated into globose hollow bodies 40 to 50 μ in diameter. Pl. 2. fig. 1.

298. *Boletus radicans* Pers. Pileus pulvinate, dry, subtomentose, from olive-cinereous becoming yellow, margin thin, involute. Stem attenu-

ated below, rooting, smooth, yellow, covered with a floccose, red pruina, becoming dark where touched; tubes adnate, pores unequal, large, citrine yellow.

Persoon Syn. p. 507, Fries Hymen. p. 503.
On the road side, *Stow* Woods, 4th September, 1898.

This well-marked species I first saw at the *Copenhagen* Fungus Exhibition, October, 1888. The *olivaceous* pileus with a tinge of yellow on the tomentum is very distinctive. It is probably often overlooked as B. chrysenteron.

**Polyporus umbellatus* Fr. A specimen of this rare species was sent for identification from the Museum *Haselmere*, 9th August, 1898. It has been recorded from *Epping Forest*. Resembling *P. intybaceus* in colour, it is easily distinguished by the fact that each branch is a *bonâ fide* pileus, which is complete and umbilicate.

299. *Polyporus fragrans* Peck. Fragrant, pileus tough, fleshy, effuso-reflexed, imbricated, 3-5 cm. (one to two inches) long, 5-10 cm. (two to four inches) broad, rather thin, but sometimes thickened at the base, velvety to the touch and clothed with a minute innate tomentum, pale reddish grey or alutaceous, the thin margin concolourous and sometimes a little roughened, often sterile beneath; flesh slightly fibrous, zonate, concolourous; pores minute unequal angular, about 2-3 mm. (one line) long, the dissepiments thin, acute, toothed or lacerated, whitish, becoming darker with age, and blackish stained when bruised.

Peck. 30th Report 1878 p. 45, Saccardo Syll. vi. p. 124.

This is a very common species, which is usually regarded as *P. fumosus*, but the sweet smell readily distinguishes it. It is by no means confined to elm stumps. Specimens were sent me by Mr. Peck from *Albany*, U.S.A., many years ago, which agree with our British plant.

300. *Coprinus dilectus* Fr. Pileus cylindrical, then campanulate, finely striate, rosy white, then pale tawny, floccose or mealy, 1-2 cm. broad; stem 5-7 cm. long, whitish and *sprinkled with red powder*; volva reduced to whitish spreading squamules at the base of the stem; gills free, reddish brown, then black; spores 10×6 μ.

On dead and partially buried hawthorn sticks, Sea Bank, *King's Lynn*, *Norfolk*, November, 1898.

This beautiful addition to our flora comes near *Coprinus roseotinctus* Rea, but is apparently quite distinct. The red or rather deep orange meal soon disappears.

**Hygrophorus fœtens* Phillips. This interesting species was found on 27th September, 1895, growing amongst short grass on the Old Sea Bank at *Nottingham Point*, *King's Lynn*.

**Cyphella cuticulosa* Dicks. Spores oval, 6-8 × 4-5 μ. At first digitaliform : exactly the plant figured by Dickson.

On dead grass (*Triticum*), Sea Bank, *Terrington*, *King's Lynn*, 30th December, 1898.

301. *Ditiola (Dacryopsis) ulicis* n. sp. Pale lemon yellow becoming darker, tough, head globose then flattened, then wrinkled, at first slightly villous with a thin, white, hyaline tomentum from 1·5-5 mm. across ; stem firm, paler than the pileus, from ·5-1 mm. long, sometimes absent or extending only from the wood through the bark; hyaline-villous when young ; spores various in form. At first elliptico-cylindrical hyaline 15 × 5 μ., with four or five very marked nuclei, the outlines of which are more obvious than the spore-wall. Older spores more cylindrical, hyaline, mostly unseptate, with an oblique, large apiculus at the base, when quite mature cylindrical, triseptate 15-18 × 5 μ. Basidia slender branched.

On the dead stems of *Ulex europæus*, *North Wootton*, 26th Jan., 1899.

This fungus, which is very common, appears to have been overlooked as a young *Tremella*. It differs from *D. radicata* Fr. in being larger in the head, stouter in the stem, and not distinctly tomentose. The *D. nuda* Berk. Ann. Nat. Hist. No. 375 pl. xi. f. 14 comes nearer, but there is a total absence of the small conidia figured by Mr. Massee, presumably from an authentic specimen. Both these plants were on fir wood, whereas the present species appear to be confined to *Ulex*. *Ditiola* is such a natural though small genus that it seems undesirable to break it up without very good reason.

Pl. 2 fig. 2 four plants natural size ; on fig. 3 conidia; fig. 4 unseptate spores; fig. 5 fully developed spores; fig. 6 young basidia.

302. *Lycoperdon lacunosum* Bulliard t. 52. Specimens answering to the above were found on *North Wootton* Heath, 22nd October, 1896. It is by no means impossible that the fungus figured by Bulliard is distinct from *L. gemmatum*. The peculiar depressed pits on the stem are very marked in dry specimens.

**Geaster mammosus* Chev. In considerable abundance on an old hedge bank at *Hillington*, near *King's Lynn*, October, 1896, near the habitat of *G. coliformis Pers.*

303. *Ascochyta perforans* Rob. Perithecia scattered, minute, black, ellipsoid, immersed, ostiola short, perforating the epidermis then falling off ; spores hyaline, elliptical, rather acute uniseptate.

On *Ammophila arundinacea*. *Heacham Beach*, 8th January, 1899. Apparently the spermogonia of *Metasphæria sabulatorum* according to Saccardo.

304. *Dinemasporium hispidulum* Schrad. Perithecia clustered or scattered, rather large, cupshaped, black, hairs rigid, long, straight, obscurely septate, disc glaucous, spores elongate, fusiform, curved 14-18 × 2-2·5 μ, with three or four nuclei and an oblique, short, hairlike appendage at both ends.

Schrad. Jourl. Bot. 1799 II. p. 64. Fries Summa. p. 367.
Saccardo Sylloge. Vol. III. p. 685. Spec. Vent. p. 139. t. xvii. f. 16.
On dead wood (elm) in a wood yard, *King's Lynn*, Dec., 1898.

305. *Uromyces chenopodii* Duby.

Ædidiospores. Peridia in circles of from 5-10 mm. each, amphigenous 1 to 1·5 mm. in diameter, subcylindrical, bright golden yellow, margin torn. Spores colourless, with golden yellow contents, subglobose 20-23 μ in diameter.

Uredospores. Sori pale brown, generally elongate, sometimes confluent, erumpent surrounded by the conspicuous torn epidermis 1-3 mm. long. Spores oval, rarely subcylindrical, pedicellate brown, epispore echinulate: 20-25 + 18-20 μ.

Teleutospores. Sori elongate dark brown pointed at the ends, mostly cauline, at first covered seated on bright orange spots, then naked 5-10 mm. long.

Spores brown, smooth, oval or subpyriform, apex only slightly if at all thickened, 20-35 × 18-20 μ, pedicels long, pale brown, persistent, 5-8 × 60-80 or even 100 μ.

Ædidium chenopodii, "Gardeners' Chronicle," 3 Aug., 1895, p. 135.
Uromyces chenopodii (Duby) Saccardo Syll. Vol. VII. p. 548.
Uredo chenopodii (Duby) Bot. Gall. II. p. 899.
Uromyces giganteus Speg. Dec. Myc. Ital. No. 30.
Ædidium chenopodii-fructicosi D.C. Flora franç. VI. p. 92.
Saccardo Syll. VII. p. 819.
Cæoma chenopodiatum Link. Species Plant. II. p. 45.
Uredo chenopodii Spr. Syst. IV. p. 574.

Terrington Marsh, August, 1893, Mr. Herbert G. Ward. *North Wootton Marsh*, 1893, C.B.P. The æcidiospores were also found near *Worthing* by Miss A. L. Smith, "Journal of Botany," May, 1898.

On stems, branches and leaves of Suaeda maritima.

306. *Puccinia (micropuccinia) Ribis D.C. Teleutospores.* Sori round, orbicular, surrounded by a discoloured yellow zone, chestnut-brown spores, crowded, oval-rounded at either end, apex thickened and expanded, constriction little or none, 20-30 × 15-20 μ verrucoso-punctate, beautiful chestnut-brown, pedicels short.

De Cand. Flor. franç II. p. 221 Schröt. Pilz. Schles. p. 345.
Puc. granulata DeBary. "Gardeners' Chronicle," 11 Aug., 1894, p. 135.

On red currant leaves. Rev. Dr. Keith, Dallas Manse Garden, *Forres*, 16th July, 1894.

307. *Puccinia (micropuccinia) Schœteri* Pass. Sori surrounded by a brownish violet discolouration of the leaf, large, oblong, solitary or in small clusters, covered or surrounded by the epidermis. Teleutospores subelliptical, at first golden then chestnut-brown, 40-60 × 25-27 μ, obscurely reticulate, rounded at both ends or the base at times attenuated; slightly constricted, if at all, pedicels very short, thick, hyaline, deciduous.

W. G. Smith, "Gardeners' Chronicle," 8th June, 1889, with fig.

On *Narcissus poeticus*. Rev. C. Woolley Dodd, *Malpas*.

Mr. Dodd very kindly sent me specimens. The spores were found not to germinate at once. The affected foliage was, therefore, placed on the ground near three or four plants of *Narcissus poeticus*, and secured in this position by being weighted down with stones. In due time it decayed and disappeared, but when the bulbs sent up leaves the following spring the tips of the leaves were affected by the fungus. They have produced sori of the Puccinia every year since, but on the tips only.

308. *Puccinia (Hemipuccinia) Acetosæ* Schum. Sori scattered on the leaves minute, irregularly rounded, on the stems and petioles elongated, soon naked. *Uredospores* globose, elliptical or pyriform 25-30 × 20-25 μ, aculeate, brown. *Teleutospores* oblong or subclavate, constricted, apex rounded 30-45 × 20-25 μ, slightly verrucose, chestnut brown, pedicels hyaline, rather long, slender, deciduous.

Saccardo Sylloge VII. p. 638.
Winter Pilze p. 187.

Schröt. Kryp. Flor. Schless. III. p. 389.
Uredo Acetosæ Schum. Saell. II. p. 231.
On *Rumex Acetosa*. Mr. A. W. Saunders. *Malden, Yorks*, 16th July, 1894.

**Puccinia (Heteropuccinia) Scirpi* D.C.

Æcidium Nymphæoides D.C. Epiphyllous, cups arranged without order on rounded spots or in concentric clusters scutellæform, margin scarcely projecting, entire. *Æcidiospores* angular 12-20 μ, orange yellow.

On the leaves of *Villarsia Nymphæoides* (Limnanthemum peltatum) in the "Old Bedford," *Earith*, July, 1895. C.B.P. in "Gardener's Chronicle" 27 July 1895 p. 96.

The Puccinia was found floating down the river Ouse at *King's Lynn* on 17th November, 1877, the host plant *Scirpus lacustris* having been cut out of some of its tributaries. It was not until 1894 that the teleutospores were found in situ at *Earith* in Bedfordshire. A visit the following year instantly revealed the Æcidium in profusion.

309. *Puccinia (Heteropuccinia) dispersa* Erick. Æcidiospores= Æcidium Anchusæ.

Uredospores Sori 1-1·5 mm. long scarcely 1 mm. wide scattered, not confluent epiphyllous brown; spores globose or shortly elliptical, echinulate, yellowish 20-30 μ.

Teleutospores Sori, covered by the epidermis, more or less scattered, forming more or less scattered black lines upon the under side (seldom on the upper) of the leaves. Each spore-group formed of numerous lines, each of which is surrounded by a crown of brown, curved, overarching paraphyses. Spores with short pedicels, mostly elongate clavate unsymmetrical. Spores 40-50 μ long, the breadth of the lower cell 12-15 μ, of the upper 14-20 μ; spores germinating in autumn. The promycelium is colourless.

Æcidiospores on *Lycopsis arvensis* in autumn.
Teleutospores on wheat, rye.
Eriksson and Henning record it on *Bromus arvensis* and *mollis*.

The teleutospores are with great difficulty distinguished from those of *P. glumarum*, but the uredospores are totally different, the sori of

those of *P. dispersa* being brown, scattered, and few. The promycelium spores and germ-tubes of *P. dispersa* are colourless.

310. *Puccinia glumarum* Schum.

Æcidiospores unknown.

Uredospores Sori ·5-1 mm. long by ·3-·4 mm. wide linear, on the leaves in long confluent colonies seated upon yellow discoloured spots often 70 mm. long, very destructive inside the paleæ and upon the immature kernels. Sori citron yellow. Spores spherical or shortly elliptic echinulate, yellow 25-30 μ.

Teleutospores Sori covered by the epidermis on the sheaths and stems in long fine brown or black lines, on the inner side of the paleæ more scattered. Each spore group is divided in numerous compartments, each of which is surrounded by a circle of dark brown, over-arching paraphyses. Spores shortly pedicellate, generally clavate unsymmetrical, apex flattened or with one or two bluntly pointed laternal projecting continuations. Upper cell 30-40 × 16-25 μ, lower 9-12 μ broad. Spores germinating in autumn. Contents of the promycelium yellow.

On wheat, barley, rye, and many grasses.
Synonyms. Puccinia rubigo-vera D. C. P. striæformis Westd. P. straminis Fckl.

Readily distinguished by the naked eye from *P. dispersa* while in the uredo stage from the fact that the spores are yellow, extremely abundant, and seated upon large elongated yellow spots, which often occupy half the blade. This is the early spring-rust. On the foliage it does but little harm in this country, but when it establishes itself, as it often does, in the chaff and on the wheat kernels, it seriously damages the latter.

311. *Melampsora vernalis* Niessl. Teleutospores in small, irregular, yellow brown, mostly densely crowded sori. Spores oblong or clavate unilocular, intercellular, as much as 45 μ long, yellowish brown.

Niessl, in Winter Die Pilze p. 237. Sacc. Syll. VII. p. 592.
On the leaves of *Saxifraga granulata*.
Mr. J. Taylor, *Portlethen*, Scotland, 12th June, 1890.

312. *Melampsora galii* Link. *Uredospores* sori minute, round, pustular, yellowish red, scattered or gregarious, pseudoperidia hemispherical, apex perforate, spores elliptical or ovoid 14-25 × 10-17 μ, aculeolate,

orange yellow. *Teleutospores* sori irregular, on spots of various sizes, formed in the cells of the epidermis and filling them, forming minute black confluent crusts. Spores rounded cuboid, generally longitudinally (quadrilocular-septate) attaining a length of 26 μ.

Thecospora Galii (Link) De Ton. Sacc. Syll. VII. p. 765. *M. Galii* Wint. Die Pilze p. 244. *Cæoma Galii* Link Sp. II. p. 21. *M. guttata* Schroet. *Uredo sherardiæ* Rostrup.

On *Galium verum*, 1889. Mr. H. T. Soppitt.

313. *Cæoma Ari-italici* Requ. Hypophyllous, sori generally irregular, flattened, orange yellow, without order or concentricaly arranged, often confluent. Spores round or elliptical, often subangular 15-30 × 15-20 μ verrucose, orange yellow.

Sacc. Syll. VII. p. 868. Cæoma Ari Wint. Die Pilze p. 256. Uredo Ari-italici Requ. Duby Bot. Gall. II. p. 899.

On Arum maculatum.

Mr. E. J. Tatum, near *Salisbury*, April, 1897.

314. *Schœteria delastrina* Winter. Sori bluish grey, pulverulent, developed in the fructification and seeds, spores joined in pairs, rarely in triplets, flattened at the point of contact, epispore greyish blue, irregularly verrucose 15-23 × 8-12 μ, promycelium mostly simple, ampullæform, short, rarely filiform, with lateral branches, sporidia globose at the apex of the promycelium, often in chains.

Fakenham, Norfolk, June, 1889, in the capsules of *Veronica arvensis*.

315. *Urocystis Filipendulæ* Fckl. Sori black, then torn, pulverulent, spore-masses as much as 44 mm. long, variable, central spores 1-7 μ round or angular, brown 15-25 × 10-15 μ punctate, peripheral spores irregular subglobose as much as 12 μ, often scarcely distinguishable from the central spores 6-12 μ, brown, sporidia cylindrical.

Fckl. Symb. Mycol. II. p. 12. Winter Die Pilze p. 122. Saccardo. Sylloge Vol. VII. p. 520.

On the petioles and midribs of the radical leaves of *Spiræa Filipendula*, Darnford Down, *Salisbury*, May, 1897. Mr. Tatum.

316. *Tilletia Rauwenhoffii* F. v. W. Sori irregular, black, spores globose 25-30 μ, epispore formed of two layers, the inner olive brown, the outer 3-4 μ thick hyaline areolate with widely hexagonal, scarcely prominent reticulations.

Sacc. Syll. VII. p. 484. Fisch. v. Wald. Aperçu. p. 50. Polycystis Holci West.

On the fructification of *Holcus mollis*, *Doncaster*, 17th September, 1891, at the Meeting of the Yorkshire Union.

**Onygena pilifera* Fr. This curious species occurred on the ejected pellet of an owl on *Ashwicken* Fen, 25th June, 1897. Mr. T. Petch.

317. *Xylaria longipes* Nitschke. Stroma erect or variously curved, growing on the thicker, fallen, decaying, decorticated branches, generally single, sometimes 2-3 joined at the base. Ascophore generally simple, terete, cylindrical, thick, apex very obtuse, rounded more rarely ventricose inflated, oblong, very rarely compressed, entire or bipartite, superficially reticulato-rimose, at first clay-coloured then black, ostiola small, hemispherical, prominent, nigropunctate. Stem variable in length, but always much thinner than the ascophore and attenuated, thickened and tuberose at the base, with thick, distinct or interwoven and adpressed, reddish black hairs, smooth above, plicato-rugulose, at first clay-coloured then brown. Conidiiferous hymenium greyish white, soon disappearing, conidia obovate, small $8 \times 4\text{-}5\ \mu$ on very short sterigmata, acrogenous. Perithecia immersed, not prominent, small, globose or compressed, crowded but uniseriate. Asci cylindrical, stipitate octosporous $80\text{-}100 \times 7\text{-}8\ \mu$ (sporiferous portion). Sporidia obliquely uniseriate, ovate, unequilateral, black $11\text{-}14 \times 5\text{-}6\ \mu$.

Nitschke Pyren. Germ. p. 14. Sacc. Syll. I. p. 328.

On dead Sycamore *(Acer Pseudo-platanus)* branches, *Docking*, near *King's Lynn*, September, 1896.

This species occurred in considerable abundance and is evidently an autumnal one. It is distinct from all forms of *X. polymorpha* by reason of its much smaller perithecia. From *X. corniformis* the larger size of the sporidia and asci as well as the development of the stem and other characters separate it. The sporidia are binucleate.

Plate 2, f. 7 and 8 two specimens natural size, f. 9 section of apex of ascophore showing the small perithecia, f. 10 and 11 asci and parphyses, f. 12 binucleate sporidia.

318. *Xylaria Tulasnei* Nitschke. Apex of the club acute. Stroma growing from the ground or from rabbit's dung, simple, black, slender, filiform, flexuose or contorted, base variously thickened, sclerotiform, often just below the club, but not at the base, covered by an abundance of dense hairs, variable in length, conidiiferous hymenium grey, conidia very minute obovato-globose. Ascophore globose or greatly thickened at the base, apex sterile, acute, attenuated to a point. Perithecia prominent mammillate rather large, asci cylindrical, shortly pedicellate, octosporous, with very long, filiform, thin and septate pseudo

paraphyses. Sporidia subuniseriate, broadly ovate, very obtuse, straight, black, unicellular, surrounded by a thick hyaline, layer of mucous 24 × 12-14 μ.

Nitschke Pyren. Germ. p. 8. Sacc. Syll. I. p. 334. Xylaria pedunculata Fr. X. pedunculata f. pusilla Tul. Sel. Fung. Carp. II. p.18 t. II. f. 1-38. Rabh. Exs. No. 636.

This is a very curious Xylaria. The head seldom exceeds in size a lentil or small pea. When growing on rabbit's dung there is hardly any stem, the whole fungus consisting of a nodose, black, coriaceous excrescence. If, however, the ground in the immediate vicinity of the affected pellet be searched, the heads of other specimens will probably be found, just projecting above the earth. On digging these up it will be seen that each constitutes the terminal extremity of a pretty long stem from 1-5 or 6 cm. (½ to 3 inches). The upper part of the stem immediately below the ground level is densely hairy for a variable distance, in some cases for 4 or 5 mm., in others for 2 or 3 cm. The thickness of the stem varies from that of a mere thread as fine as horsehair to 2 or more mm. Sometimes it ends in what may have been a sclerotium, in others it seems to be lost in the ground. The globose head is surmounted by a sterile conical point. Mr. Broome, who found this fungus near *Bath* and communicated it to Rabenhorsts' Exsiccati (636), was of opinion that the base of the buried stems originated from and in buried pellets of rabbit dung. It occurs on heaths and is in fruit from October to February.

Pl. 2, f. 13 three specimens of X. Tulasnei natural size, the heads only were above ground, f. 14 three specimens on a pellet of rabbit's dung natural size, f. 15 section of ascophore showing the barren apex, f. 16 ascus and paraphyses, f. 17 sporidia.

319. *Philocopra discospora* Nov. sp. Perithecia semi-immersed or free, elongate-conical, black, paler below. Ostiola surrounded by a crown of rigid, straight, black, simple setæ. Upper part of the perithecia sparsely setulose, setæ simple, black, short, sometimes curved. Perithecia 400-500 × 250 μ, asci polysporous, cylindrico-fusiform, tapering at either end, sessile 130-150 × 18-20 μ, paraphyses as long as the asci, simple, hyaline, linear. Sporidia at first yellow, then dark brown, finally black, arranged without order in the asci, a little longer than wide, discoid 7-8 × 6-8 μ.

On rabbit dung, *North Wootton* Heath, January, 1899.

It differs from P. polyspora in the shape of the asci,—discoid sporidia and other points.

Pl. 2, f. 23 perithecium, f. 24 ascus and paraphyses, f. 25 sporidia.

320. *Rosellinia malacotricha* (Auersw.) Niessl. Perithecia gregarious, often densely crowded, conical or subglobose 200-300 μ in diameter, carbonaceous, surmounted by rigid, fasciculate, black hairs, ostiola smooth, shortly conical, shining. Asci octosporous, cylindrical, stipitate, apex blunt 100 × 10 μ, sporidia uniseriate, discoid or elliptical or semiorbicular 10-15 × 8-10 μ, at first binucleate, yellowish, then black brown, paraphyses guttulate, scarcely exceeding the asci in length.

Niessl Beiträge p. 36 t. v. f. 36. Saccardo Sylloge. I. p. 270. Fungi. Ital. t. 593.

On dead fir wood, West Briggs Wood, Wormegay, *King's Lynn*, 15th December, 1898.

321. *Delitschia Marchalii* Berb. and Vogl. Perithecia gregarious, very minute, subglobose, asci cylindrical, rather acute, shortly attenuated below 75-85 × 11-13 μ octosporous, paraphyses few and small, sporidia generally obliquely uniseriate, elliptical, obtuse, slightly constricted at the septa, at first hyaline then brown, surrounded by a narrow hyaline zone, not separating at the septum 10-12 × 5-6 μ.

Saccardo Syll. Vol. IX. p. 747.

On rabbit dung, *Castle Rising* Heath, 26th December, 1898.

Remarkable for its very minute sporidia.

322. *Sporormia Marchaliana* Mout. Perithecia gregarious, globose, ·5 to ·75 mm. in diameter, immersed or superficial, black; ostiola papillæform, thick and short; coriaceous though carbonaceous. Asci narrowly clavate, stipitate, octosporous, sporiferous portion 170-200 × 20-25 μ paraphyses filiform, branched, sporidia 1-3 seriate above, uniseriate below, cylindrico-fusiform, obtusely rounded at both ends, slightly curved, brown 11-13 septate, easily separating at the septa; the intermediate segments wider than long, surrounded by a layer of hyaline gelatin 60-75 × 8-10 μ.

Mouton in Bull. Soc. Roy. Bot. Belg. 1886 p. 155. Saccardo Sylloge. IX. p. 819.

On rabbit's dung, *Castle Rising* Heath, 26th December, 1898.

Plate 2, fig. 21 ascus f. 22 sporidia.

323. *Sporormia microspora* Nov. sp. Perithecia small, semi-immersed, black, globose or subconical, scattered, smooth, about 200-250 μ in diameter, ostiola inconspicuous. Asci cylindrical, octosporous, sessile, 100-120 × 10-12 μ. Paraphyses few, filiform, branched hyaline. Sporidia uniseriate, cylindrical, triseptate, pale then dark brown, con-

stricted at the septa, segments rather unequal, surrounded by a thin layer of gelatin $15 \times 5\ \mu$.

On rabbit's dung, *North Wootton* Heath, 18th January, 1899.

The form and colour of the sporidia recall those of Melanomma pulvis pyrius.

Plate 2, fig. 18 perithecium, f. 19 asci and paraphyses, f. 20 sporidia.

324. *Gibberella cyanogena* (Desm.) Perithecia crowded, oblong, 150-200 μ in diameter, obtusely conical then collapsing, umbilicate, plicate and verrucose, dark amethyst blue. Asci clavate, octosporous, obtuse above, sporidia fusiform oblong, sometimes straight, sometimes slightly curved, obtusely rounded at either end, subhyaline, triseptate, slightly constricted, $25\text{-}30 \times 7\ \mu$. Mycelium branched, effused, crustaceous, yellowish. Conidia sometimes solitary, sometimes cæspitose-fusiform, lunate, apiculate, 1-3 rarely 5 septate subhyaline.

Spheria Cyanogena Desm. Ann. Soc. Nat. X. 1848 p. 352. Gibberella Cyanogena Saccardo Syll. II. p. 555.

On an old cabbage stalk, Sea Bank, *King's Lynn*, December, 1898. *Halifax*, Mr. Crossland, January, 1899.

The spores are larger than those of G. pulicaris, which is found on *Sambucus*.

325. *Diaporthe (Euporthe) incrustans* Nke. Stroma effused, variable, staining the matrix. Perithecia minute, globose, rarely depressed or angular, abruptly attenuated at the neck. Ostiola elongate, often erumpent in clusters, very black. Asci narrowly clavate, octosporous, $50\text{-}65 \times 7\text{-}9\ \mu$. Sporidia biseriate or obliquely uniseriate, straight or very slightly curved, subhyaline, uniseptate, quadrinucleate $12\text{-}14 \times 3\ \mu$. Spermogonia Phoma-like spermatia $5\text{-}7 \times 2\text{-}2{\cdot}5\ \mu$, basidia 30 μ long.

Nits. Pyren. Germ. p. 267. Saccardo Sylloge. II. p. 655.

Castle Rising, on cabbage stalks, 1st January, 1899.

SOME CURIOUS MOULDS.

By Greenwood Pim, M.A.

While working at Fungi some curious species belonging to the Hyphomycetes and allied groups have come under my notice, to one or two of which I would like to direct the attention of the British Mycological Society.

1. *Botrytis dichotoma* Ca. This remarkable form does not appear in Cooke's Handbook, nor can I trace it in Massee; the dichotomous branching of the hyphae, with the spores dotted all over like pins in a pincushion, seems to agree exactly with the figure in Corda's Icones. It occurred in my garden at *Easton Lodge*, *Monkstown*, County *Dublin*, on a dead tulip stem.

2. *Stysanus stemonitis* Ca., var *ramosa* Pim. The interest in this consists in the fact that according to both Cooke and Massee the stem is always simple, while in the specimen in question it is repeatedly branched, each branchlet ending in the usual head of spores.

3. *Pimina parasitica* Grove.

Some years ago when examining a specimen of *Polyactis* growing on decayed leaves of Passiflora princeps, I noticed a curious black mould parasitic on the *Polyactis*. Being unable to determine it, I sent specimens to Mr. W. B. Grove, who considered it a new genus and species, for which he suggested the name of Pimina parasitica. Till quite recently I believed it was undescribed, but I have discovered that he described it under that name in the "Journal of Botany" (Vol. XXVI.) for July, 1888, p. 206, as follows:—

"*Pimina.* Sterile hyphæ creeping, hyaline, or somewhat "coloured; fertile erect, dark, crowned above with basidia; "conidia simple, hyaline, acrogenous. A genus closely allied to "*Stachylidium* of Fuckel, but distinct in habit.

"*P. parasitica*. Sterile hyphæ long, flexuous, very slender, "here and there septate, and coloured between the septa. Fertile "hyphæ short arising from the coloured part, clavate formed of "twin cells, the inferior cylindrical, olivaceous, the superior sub-"falcate, clavate, blackish; apex crowned with oblong-ovate "sterigmata, mostly in fours. Conidia globose solitary acrogenous "5μ in diameter. Habitat, parasitic on hyphæ of Polyactis on "the under side of dry leaves of Passiflora princeps and P. "quadrangularis in Mr. Greenwood Pim's garden at *Monkstown*, "Co. *Dublin*, *Ireland*."

As the plant was overlooked by Mr. Massee when dealing with the Hyphomycetes in his British Fungus Flora, and has never been figured, it seemed worth while to note it in the Transactions of the British Mycological Society, at whose meeting in *Dublin* in September 1898 it was shown by me.

Careful search has failed to discover any other specimens, so that the existing ones, so far as I know, are unique. The type has been deposited in the British Museum. Pl. 1.

Other interesting species are Papulaspora sepedonioides, Myxotrichum chartarum Kzc. and M. deflexum, Berk., Helicomyces roseus, Link, Ramularia rapæ Pim, &c. A curious black mould occurred on a decaying Sapuçaya nut. It resembled Aspergillus very strongly, but differed in having the strings of spores, attached to very delicate hyphæ depending from the columella. It was described in Proc. R. I. Acad., 1883, as Alliaspora Sapuçayæ, Pim.

In conclusion I may mention a remarkable plant, though not a Hyphomycete, that I discovered on grass in a silo at *Glasnevin* Model Farm and which was described by me in the Gardeners' Chronicle for 22nd December 1883. Mr. Worthington G. Smith described it in his "Diseases of Field and Garden Crops," p. 68, as Saprolegnia philomukes as it was parasitic on Isaria fuciformis and partook of the bright red color of the host.

TWO SCLEROTIA DISEASES OF POTATOES.

By Professor E. J. McWeeney, M.D.

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The sclerotium disease of potatoes is a malady which is very widespread in certain districts, especially along the western and northwestern seaboard of Ireland. This disease assumes two distinct forms —one characterised by large, compact fungal masses (the sclerotia), hanging loosely in the pith cavity of the affected potatoe plant; the other by small crumpled, inconspicuous sclerotia, firmly adherent to the outside skin (epidermis) of the leaves and stem. On planting the sclerotia belonging to the first named species they gave rise to one or several upright stalks, each supporting a small brown disc-like structure called technically *Sclerotinia sclerotiorum* Mass. This was usually about the size of a threepenny piece. On the upper surface of this were numerous oval bags called "asci," each containing eight spores. If planted on a potato these spores gave rise to threads, which penetrated into the plant, and produced after a while tuft-like masses of mycelium, the central part of which became hard and black—in other words, became a sclerotium. The affected plants soon die. This is a totally different disease to "blight," and requires different treatment. The other (smaller) variety of sclerotium when planted produces, not a peziza, but a mouse-gray mouldy growth called "*Botrytis*." This mould seems to be capable of attacking living potato plants. After killing them it produces its minute sclerotia on their withering stems and leaves. It never develops into a peziza, nor does the other peziza producing sclerotium ever produce a botrytis. By these studies, mostly carried on in the laboratory at the Albert Model Farm, the existence of two separate diseases of the potato, both characterised by sclerotia, and both eminently preventible has been demonstrated. The proper course to take is to carefully destroy by fire the withered remains of the potato crop each autumn, and not to grow potatoes on the same plot for several consecutive seasons. Deep cultivation also, with a view of burying the sclerotia out of harm's way, is very advisable. Though neither of these diseases is so much to be dreaded as the "blight," yet in certain districts they do a great deal of damage to the crop.

BRITISH MYCOLOGY.

By Miss Annie Lorrain Smith.

Mortierella Rostafinskii Bref. Untersuch. IV., p. 81.

Sporangiophores single, upright, unbranched, non-septate, cylindrical, from a swollen base which is enveloped in thread-like, septate, rhizoids, sharply constricted beneath the sporangium, colourless; sporangia globose, many-spored with a turned down, basal collar; spores globose-elliptical $6\mu \times 5\mu$ smooth, colourless; zygospores globose, 1 mm. in diameter, with a thick pale yellow, smooth epispore surrounded by an envelope of brown hyphæ—the carposporium.

In this species the zygospore acts as reserve material, the sporangiophores grow out from the envelope.

On a dead fir stump at *Strathpeffer*, *Ross-shire*, Aug., 1896, Mr. Jenkin. Journ. Bot., Jan., 1897.

Mortierella repens A. L. Sm. Journ. Bot., May, 1898.

Mycelium creeping, widely spread; sporangiophores rising from the mycelium, unbranched, slender, slightly tapering, very variable in length; sporangia globose, varying in size from 20μ in diameter without any basal collar; spores few, from five upwards, globose, 11μ in diameter.

Collected by Mr. Jenkin on damp earth, *Newport*, *Monmouth*, Jan., 1897.

M. Bainieri Cost. var. nov. *Jenkini* A. L. Sm.

Sporangiophores about 1 mm. in height, branching in a sympodial manner, tapering from 10μ in width towards the base to 5μ below the sporangium, not constricted, and without basal collar; sporangia spherical, about 25μ in diameter; spores numerous, exceedingly minute, elliptical, $3 \times 2\mu$, colourless.

Collected by Mr. Jenkin on damp earth at *Newport*, Jan., 1897.

Piptocephalis cylindrospora Bainier. Ann. Sci. Nat., Series 6, Vol. XV., p. 92.

Conidiophores without rhizoids at the base, upright, delicate, several times forked, the branches becoming always shorter, at first white, later brownish and septate; basal cell of the conidia globose, small, the upper half dotted with small projections on which are borne the conidial chains; conidia cylindrical, small $2\mu \times 4\mu$, colourless. Zygospores unknown.

On a patch of earth and moss, along with *Syncephalis*. *Newport*, Mr. Jenkin. Journ. Bot., Jan., 1897, p. 7.

Syncephalis Cornu Van Tiegh and Le Mon.

Conidiophores single, unbranched, colourless, continuous with overlapping rhizoids, the swollen top bent over; basal cell of the conidia on the apex of the swollen tip, fusiform, bearing a chain of 4-6 conidia; conidia fusiform or elliptical $10\text{-}12\mu \times 4\text{-}6\mu$, smooth, yellowish; zygospores occurring singly, globose, with a thick, yellow-brown, warted epispore, surrounded by short swollen outgrowths from neighbouring hyphæ; stylospores globose echinulate 16μ in diameter, on short stalks; chlamydospores terminal and intercalary, globose, 21μ in diameter, beset with blunt spines 6μ in length.

On a patch of earth and moss. *Newport*, Mr. Jenkin. Journ. Bot., Jan., 1897.

Leptolegnia caudata De Bary, Bot. Zeit., 1888, p. 609.

Forming dense tufts of slender, loose hyphæ, which are unbranched and blunt at the ends, the superficial hyphæ are branched and thicker. Zoosporangia elongate-cylindrical; oogonia on short side branches at the base of the primary hyphæ, usually somewhat ovate, smooth; antheridia always one or two present, obliquely clavate, diclinous; oospores single, filling the whole oogonium.

Bandon, Co. *Cork*. Allan P. Swan, F.L.S. Irish Naturalist, Vol. VII., No. 2, p. 29, Feb., 1898.

L. bandoniensis Swan, Irish Naturalist, Vol. vii., No. 2, p. 32.

Filaments sinuous and not much branched, $12\mu\text{–}14\mu$ in diameter. Sexual organs produced first, the oogonia globular,

borne at the end of long robust branches; antheridia diclinous, stout, dark; oospores globular from 5 to 20 in the oogonium, usually however about 10 in number, 20μ in diameter. Zoosporangia produced later, filamentous, the zoospores escaping by a narrow beak-like opening at the apex. Chlamydospores in large numbers, mostly developed on stout lateral branches.

Beyond telling us that these two species were found at *Bandon*, Mr. Swan has not indicated their habitat, although he mentions that there is probably no open water in *Ireland* without *Saprolegniaceae*. One of the distinctive generic characters of *Leptolegnia* is the occurrence of but one oosphere in the oogonium. Mr. Swan has placed his new species, which numbers many oospheres in *Leptolegnia*, without explaining his grounds for doing so, or without emending the genus, which would be necessary in order to include *L. bandoniensis*. Mr. Swan considers that the unusual production of chlamydospores is probably due to the conditions of culture.

Achlya apiculata De Bary, Bot. Zeit., 1888, p. 635.

Hyphæ stout 40-60μ in diameter; sporangia terminal; oogonia single, at the end of short, often bent branchlets 12μ thick, which rise in a crowded manner from the main hyphæ, elongate-ovate, ending in a sharp point, varying in size from 65μ to 75μ broad and 105μ in length, smooth with few oospores; antheridia always present, often more than one to each oogonium, borne on slender branches which rise from the main hyphæ near to the oogonial branch; oospores mostly 3-4, globose 35-50μ in diameter, smooth.

On the mouths of *Utricularia* bladders. *Strathpeffer*, *Rossshire*, Aug., 1896. Mr. Jenkin. Journ. Bot., Jan., 1897.

Sepedonium sepedonioides A. L. Sm. *Monosporium sepedonioides*, Harz. Hyph., p. 18.

Effused rosy-white; sterile hyphæ creeping, continuous filiform, with here and there short fertile branches, umbellately branched at the tips; conidia acrogenous, globose, minutely muricate, rose coloured or rarely white 10-11μ in diameter.

Found by Mr. Jenkin, *Newport*, growing on damp cardboard.

Sporotrichum globuliferum Speg. Fung. Argent., Png. II., p. 42.

Tufts large, 1·5 mm. in diameter, white, woolly floccose; hyphæ creeping, sparsely septate, hyaline, 3-4μ thick, branched

and anastomosing; conidia minute, globose or globose-elliptical, hyaline, 2-2·5μ × 1·5-2μ, densely crowded on the branches in small groups.

Found by Mr. Pycraft on the flesh of dead birds from *America*, with which it was doubtless introduced. Hitherto recorded on the decaying bodies of *Coleoptera* in *N. America*.

Botrytis angularis A. L. Sm. Journ. Bot., May, 1898.

Conidiophores unbranched, pale yellowish, the tip angularly swollen, and producing from the angles swollen bladder-like cells measuring 15 × 10μ, the stalks continuing to grow and form other heads; spores elliptical-oblong, 10 × 6μ, borne on very small projections on the swollen cells.

On damp moss and earth. Mr. Jenkin, *Newport*, Feb., 1897.

Acrostalagmus albus Preuss. Linnæa, 1851, p. 126.

Tufts effused, slender, somewhat woolly, white; sterile hyphæ creeping, continuous or spuriously septate, not much branched; fertile branches ascending or creeping, branched above in a verticillate manner; branchlets slightly curved, attenuated towards the tips; conidia borne in a spherical head on the tips of the branchlets soon falling off, very small, elliptical-oblong 3 × 1-2μ colourless.

On stalks of *Bryonia dioica*. *Cambridge*, Nov., 1896. Journ. Bot., Jan., 1897, p. 8.

Periconia pycnospora Fres., Beitr., p. 20, t. IV., figs. 1-9.

Fertile hyphæ gregarious, erect, rigid, sooty-brown, 200-300μ × 10-14μ, unbranched with few septa, paler upwards; conidia borne at the apex, at first in chains, sessile, brown, muriculate 12-17μ in diameter.

On dead herbaceous leaves. *Annan*, *Dumfrieshire*, Aug., 1896. Journ. Bot., Jan., 1897, p. 8.

Humaria Roumegueri Sacc. Peziza Roumegueri Karst., Grev. VII., p. 64.

Gregarious, sessile, fleshy, orbicular, margin distinct, thin and membranaceous, paler than the orange yellow disc; asci cylindrical, 8-spored; spores in one row, fusoid-oblong, smooth, colourless 24-27 × 9μ paraphyses curved, clavate at the apex filled with orange granules.

Growing on peaty ground in an old quarry at *Crimple*, near *Harrogate*. The species is new to Britain, only the variety *carnosissimus* Phil. having previously been met with.

Llewellyn J. Cocks, Godolphin House, *Harrogate*, 20th March, 1898. Naturalist, April, 1898, p. 104.

Mollisia chionea Mass. & Crossl. Journ. Bot., 1896, p. 154, Pl. 357, figs. 21-24.

Gregarious or crowded, sessile, but attached by a somewhat narrow base; thin and fragile, snow-white, almost translucent when moist, becoming dead-white when dry; subglobose and closed when young, gradually becoming plane, and finally slightly convex; margin minutely fimbriate externally, very delicately pruinose, about 1 mm. across; cortex composed of hexagonal cells, which are slightly elongated in the direction from base to margin, 20-25 × 10-12μ, running out into crowded parallel hyphæ of different lengths to form the irregularly fimbriate margin; asci cylindric-clavate, apex narrowed, base rather short, 40-45 × 5-6μ, 8-spored; spores irregularly 2-seriate, hyaline, continuous, smooth, narrowly cylindric-oblong, ends obtuse, straight or very slightly curved, 6-8 × 1·5-2μ; paraphyses cylindrical, about 2μ thick, scarce.

On dead or dying stems of *Carex pendula*. *Elland*, *West Yorks*. Coll. W. Needham, Oct., 1894.

Bearing some superficial resemblance to *Helotium eburneum*, which sometimes occurs on the same host, but distinguished by its larger size, absence of stem, much larger cortical cells, and somewhat larger spores. Substance soft and watery when growing.

Dasyscypha trabinelloides Mass. *Helotium trabinelloides* Rehm. Ascom. No. 853.

Gregarious or sometimes crowded sessile, at first globose and closed, then expanding, becoming again contracted when dry, entirely orange-coloured, 0·5-1·5 mm. diameter; substance thin and soft excipulum formed of radiately parallel, septate hyphæ about 4-5μ thick; externally pubescent, the hairs often arranged in groups, septate, cylindrical, obtuse, minutely rough, overtopping the entire margin and giving it a fringed appearance when seen from the outside, 50-75 × 4-5μ; asci narrowly clavate, apex slightly narrowed, 60-70 × 7-8μ; spores 8, irregularly

biseriate, hyaline, smooth, straight or very slightly curved, oblong-fusiform, 1-septate, not at all constricted at the septum, 10-15 × 3-4μ; paraphyses filiform, sometimes branched, containing orange oil-globules.

On dry decorticated beech wood. *Gomshall, Surrey.* Found on the same matrix in *Hungary* and on decaying wood of *Castanea* in the *United States.* Journ. Bot., April, 1896.

Stictis stellata Wallr. Fl. Crypt, p. 144.

Ascophore immersed, then erumpent, sessile, orbicular, small, with a black covering, then opening and shewing a horn-coloured concave disc; the outer covering furfuraceous, grumous, dirty-white, splitting in 4-6 stellate divisions at the reflexed margin; asci cylindrical 8-spored; spores fusiform, septate, colourless, 150-200 × 1·5μ.

On dead stems of *Eupatorium cannabinum. West Kilbride,* Nov., 1893. Mr. D. A. Boyd.

Pseudophacidium Callunæ Karst.

Subgregarious, erumpent, subspherical, breaking from the centre in 4 somewhat triangular laciniæ, black with a pallid disc, about 1 mm. in diameter; asci clavate 62-95 × 10-12μ; spores elliptical or oblong elliptical, eguttulate, continuous, colourless, 9-17 × 4-6μ.

On dead branches of *Calluna vulgaris. West Kilbride,* March, 1892. Mr. D. A. Boyd. Journ. Bot., May, 1898.

Lizonia de Not. Sferiæ. italici, p. 72.

Perithecia crowded superficial smooth of almost leathery consistence; spores 8 oblong, 2-celled, brownish.

Lizonia emperigonia de Not.

Perithecia in rows or small groups on the upper surface of the antheridial leaves of moss, attached by creeping brown hyphæ, ovate, blunt at the apex or with a small papilla, black, 250-300μ in diameter; asci clavate or oblong-cylindrical, shortly stalked 135μ × 18μ; spores in two rows oblong or oblong-fusiform, mostly unequal-sided, 1-septate slightly constricted 30-46μ × 10-15μ.

On the flower-heads of *Polytrichum commune.* Found by Mr.

Lloyd Williams on material in the laboratory of the Pharmaceutical Society. Journ. Bot., Jan., 1897.

Thyrsidium Hedericolum Dur. and Mont.

Pustules gregarious, globose-depressed, black, covered by the epidermis, the contents flowing out in a granular looking tremelloid mass; spores minute, globose, 3μ in diameter, olivaceous, densely aggregated into subspherical heads; borne on forked or branched filiform sporophores.

On *Hedera Helix*.

Var. *Carpini*. On branches of *Carpinus Betulus*. *West Kilbride*, July, 1897. Mr. D. A. Boyd, Journ. Bot., May, 1898.

Clavaria Kewensis Mass. Journ. Bot., April, 1896.

Base thick, dividing almost at once into numerous, subequal divergent branches 4-7 cm. long; branches uniform in thickness throughout, often compressed, imperfectly hollow, dividing near the apex into 2-4 short branchlets, axils rounded, tips obtuse or divided into 2-4 short finger-like processes; base and main branches rusty-brown, becoming ochraceous upwards, pruinose with the elliptical, colourless spores, which measure 5-6 × 3·5-4μ. Fragrant.

On rotten wood. Rock Garden, *Kew* Gardens, Oct., 1896. Forming dense tufts 5-6 in. across. A very distinct species, characterized by the rusty colour, and fragrant, spicy smell, which resembles that of *Lentinus cochleatus*.

Coprinus stellaris Quél.

Pileus ovoid, then campanulate, striate, snow-white, then greyish, *crowned with minute pellucid vesicles* 1-2 mm. across. Gills adnate, spores elliptical, about 8μ long, stem 1-2 cm. long, filiform, hyaline, velvety with slender white hairs. *Swarraton, Hants.*

Underneath side of loose clods of cow dung, in pastures. *Swarraton*, Rev. W. L. W. Eyre.

The hairs average about 45 × 10μ. The French specimens usually found in caves.

Panus rudis Fr.

Caespitose. Pileus 10 cm. across, fleshy, coriaceous, then corky, thin, unequal, excentric or dimidiate, ochraceous fawn or reddish,

margin incurved lilac and *bristling with hairs as is also the stem.* Stem short, unequal, ochraceous fawn, shaggy, with a rough haired *velvet, lilac.* Gills very decurrent, narrow, whitish pink, then pale ochraceous fawn, as is the whole fungus. Flesh white. Smell, pleasant of anise. Spores, 5-6 × 3μ, cylindrical, hyaline. On beech, *South Elkington, Lincolnshire,* May, 1895, J. B. Robinson. Distinguished by the velvety hairs on the margin of the pileus and stem.

RECENT OBSERVATIONS OF PROFESSOR ERIKSSON ON THE RUSTS OF OUR CEREALS.

By C. B. Plowright, M.D.

Since 1890. Professor Eriksson has been working experimentally on the life-history of the fungi which cause the various rusts of our cereal crops. In July of last year he delivered a lecture at Stockholm to the Scandinavian Congress of Agriculturists, in which he epitomised his nine years' work. In 1894 he, in association with Dr. Ernest Henning, published that large volume, *Die Getreideroste*, in which the authors showed that the mildew of Wheat meant a great deal more than simply Puccinia graminis with its æcidiospores on the Barberry. Continued observations have confirmed and amplified the results then obtained. Prior to the appearance of this work the cereal rusts were regarded as being due to three Pucciniæ, viz.—P. graminis P. with its æcidiospores on Barberry; P. rubigo-vera D. C., with its æcidiospores on Anchusa; P. coronata Corda, with its æcidiospores on Rhamnus. The authors found that P. graminis was divisible into two species—(1) the true P. graminis, with its æcidiospores on Barberry; (2) P. Phlei-pratensis E. & H., which occurs on P. pratense, and Festuca elatior with unknown æcidiospores. But more than this, they found that P. graminis occurs in six biologically distinct forms on Rye, Oat, Wheat, Aira, Agrostis, and Poa, which they call Forma Secalis, Avenæ, Tritici, Airæ, Agrostidis, and Poæ. Now these specialized forms, or varieties or sub-species, call them what you like, have this in common—that they all have their æcidiospores upon the Barberry; but the æcidiospores formed, let us say, from Forma Secalis on Rye, will not, when placed on Oat, or Wheat, or Poa, or Aira, or Agrostis, give rise to the uredo, but when placed on Rye they will do so. Nor will the uredospores from Rye give rise to the uredo on any of the above-named grasses. Let us go a little further: there is a certain group of grasses to which Forma Secalis is confined, this includes not only Rye, but also Barley, Twitch, Elymus arenarius, and Bromus secalinus, and to these (with one or two closely allied species, *e.g.*, Hordeum jubatum, Triticum caninum and desertorum), it is confined. The next form, Avenæ, is confined to the Oat, Avena elatior, sterilis, Dactylis glomerata, Alopecurus pratensis, Milium effusum, Lamarckia aurea, and Triosteum distichophyllum.

Far and away the most important to us, however, is the form on Wheat, which is confined to Wheat, and does not even go to Triticum repens. The importance of this fact is obvious, for in the first place there is no fear of Wheat mildewing adjacent fields of Barley, or Rye, or Oats, or being mildewed by them; nor, in the second place, is there any fear of the Wheat catching the disease from mildewed grasses in the hedge-banks, &c. Bear in mind that, although these six forms are morphologically indistinguishable, either in their æcidiospore, uredospore, or teleutospore stage, yet they are biologically distinct. Briefly, we have to deal with a form on Wheat, another on Oats, and a third common to Oats, Barley, Rye and Twitch, the other three forms being of botanical interest only.

In the same way the authors found that P. rubigo-vera D.C., was divisible into three good species, viz., P. glumarum Sch.; P. dispersa E. & H.; and P. simplex Korn. Let us say a word or two about these *seriatim*.

P. glumarum (Schmidt), the yellow rust or spring rust, as we often call it in *England*, possesses well-marked characters in its uredo stage, by which it can be recognised with the naked eye, inasmuch as the minute uredospore-beds occur on large elongated yellow patches on the leaves. The teleutospores are scanty in proportion to the uredo, and the sori minute.

This rust owes its chief interest to two things: First, its great abundance and its conspicuousness alarm the Wheat-grower, making him think that his crop is going to be "mildewed," whereas, in reality, it rarely causes any appreciable diminution of the yield. Secondly, because it has the habit of sometimes developing its uredospores upon the chaff (Cosh) of the affected Wheat-plants, hence its specific name —Uredo glumarum. When this happens, it does injure the crop, because the uredospores spread from the chaff to the kernels themselves, causing them to be distorted, and more or less abortive. On many of these damaged kernels one can find spore-beds of the teleutospores when the grain reaches maturity.

In a similar manner, P. glumarum is met with in five specialised forms, viz., Tritici, Secalis, Hordei, Elymi, and Agropyri, on Wheat, Rye, Barley, Elymus, and Triticum repens respectively.

Puccinia dispersa E. & H.—The brown rust is not nearly so conspicuous, nor is it so abundant as P. glumarum. It is met with later in the season in *England*, not long before harvest. The uredo sori are like immature spore-beds of the uredo of P. graminis, only they

are very much smaller. The teleutospores are so like those of P. glumarum as to be only distinguished with difficulty. It has its æcidiospores on Anchusa in autumn, those of P. glumarum being unknown. P. dispersa has four forms—on (1) Rye, (2) Wheat, (3) Twitch, and (4) on the Bromi.

Puccinia simplex (a species first described by Kornicke) has been known for many years. It is confined to Barley, and is common in *England*; it is easily recognised by the large number of its teleutospores, which have one cell abortive.

Secondly, there are the crown rusts, P. coronata and coronifera, whose life-history has been worked out by Klebahn. The former has its æcidiospores upon Rhamnus frangula, and is met with in five forms, according to Eriksson, viz., 1, Calamagrostidis; 2, Phalaridis; 3, Agrostidis; 4, Agropyri; 5, Holci. The latter (P. coronifera) has its æcidiospores on R. catharticus, and occurs in 6 specialised forms, viz., 1, Avenæ; 2, Alopecuri; 3, Festucæ; 4, Lolii; 5, Glyceriæ; 6, Holci.

Eriksson draws attention to the fact that the extension of rust (uredo) from plant to plant is after all usually confined to a few yards. For instance, P. graminis on Twitch is one of the commonest forms in *Sweden*, as it is in *England;* if one searches in the vicinity of a Barberry-bush, one is almost sure to meet with it, but the affected plants are not found many yards from the bush. This form, it will be remembered, also occurs on Barley and on Rye, but although it is common enough on Twitch it seldom spreads, and then only to a limited extent to the above-named cereals. A further instance, showing how limited these uredospores often are, is given, which occurred at the experimental station at Stockholm in 1894, where a plot of Horsford's Pearl, a variety of Wheat specially liable to P. glumarum, was grown between five other varieties. On the Horsford the characteristic uredo first showed itself on May 11th, and in forty-three days had attained its maximum, but at the end of that period only three of the surrounding plots showed any signs of this rust, and these only to a very slight degree.

The germinating power, both of the uredo and of the æcidiospores, is often but small and at best capricious. Eriksson considered, upon reflection, that since Roman times, hot days and cold nights have been considered favourable to mildew, he resolved to try the effect of placing these spores upon ice for some hours, and by doing this he succeeded in arousing them to germination. The distance to which the æcidiospores are capable of spreading the fungus from an individual æcidial

host-plant he considers has been greatly over estimated. Julius Kühn in 1875 thought 100 mètres (120 yards) might be considered the limit, but Eriksson puts it at from 10 to 25 mètres (12 to 30 yards). The dissemination of the mildew in India, for instance, where the nearest Barberry is 300 miles away, on the Himalayas, cannot be effected by the æcidiospores. He found, too, that in *Sweden* the uredo on Triticum repens, beneath a Barberry-bush, sometimes appears before the æcidiospores on that bush ; or at any rate, before it had time to originate fron the æcidiospores. Further, the teleutospores on P. graminis are capable of germination in spring only, and then only after they have been exposed to the vicissitudes of the previous winter, hence mildewed straw kept in a barn or in a stack is not dangerous. Further, he finds that it is those teleutospores only which have been developed in late autumn that are capable of germinating next spring.

Let us recapitulate these statements :—

1. That there are a multiplicity of different spore forms capable of affecting certain special host plants only.

2. That the uredo and æcidiospores exhibit a certain degree of obstinacy and capriciousness in germination.

3. The short distance they are capable of extending the fungus.

4. The fact that the uredo has been observed before the æcidiospores.

5. The limited germinative faculty of the teleutospores.

Taking into consideration the above facts, it is improbable that the general dissemination of rust takes place in the usually accepted manner, viz., from separate centres and by geometric progression.

In *Sweden* the dominant rust is Puccinia glumarum, and this form Eriksson has made the subject of special study, with the particular object of elucidating this question. In the first place he noticed that the uredospores in spring appeared on the young plants of certain varieties four or five weeks after the Wheat had been sown. and in the second place that sunniest parts of the fields were sometimes worse affected than the shady. These observations induced him to try the following experiment : young plants immediately after the melting of the snow in spring, were enclosed in wide glass tubes carefully packed at both ends with cotton-wool. In from six to eight weeks Uredo glumarum appeared upon them. It is possible that this may have resulted from an infection in autumn, although it is not probable for one would have *cæteris paribus* expected had this been the case that the uredo would have shown itself sooner. He therefore sowed

seeds of a variety of Barley extremely susceptible to yellow rust in sterilized soil, and properly protected from external infection, yet even then a certain proportion became rusted. He therefore concludes that the fungus arose from "internal germs inherited from the parent plant," which can only be detected just before the eruption of the young pustules. Hence, the fungus lives for a long time a latent symbiotic life as a mycoplasma in the cells of the embryo, and only assumes the visible form of mycelium just before the eruption of the sori. Therefore the severity of an attack of rust (or mildew) depends: (1) On the external surroundings, the environment of the plant, the weather, the soil, manuring, &c.; if these conditions be favourable, the latent mycoplasm ceases its symbiotic existence and develops into mycelium and spores. (2) On the accession of external infective material, i. e., spores from without. The mycoplasmic symbiosis of P. glumarum is more energetic in such varieties as Horsford's Pearl, which is especially liable to this rust than in Squarehead, which is practically exempt, because the symbiotic existence of the parasite with this variety is so languid as to be practically non-existent.

Table of Eriksson's Spore-forms of the Pucciniæ of the Cereals.

Puccinia graminis P. (Æc. berberidis)	1 Secalis	On Rye, Barley Twitch, &c.
	2 Avenæ	on Oat, Avena sp. Dactylis, Alopecurus, &c.
	3 Tritici	on Wheat.
	4 Airæ	on A. cæspitosa.
	5 Agrostidis	on A. vulgaris, &c.
	6 Poæ	on P. compressa,&c.
P. Phlei-pratensis E. & H.	- - -	on P. pratense, Festuca elatior.
P. glumarum Sch,	1 Tritici	on Wheat
	2 Secalis	on Rye.
	3 Hordei	on Barley.
	4 Elymi	on E. arenarius.
	5 Agropyri	on Triticum repens.
P. dispersa E. & H. (Æc. Anchusæ)	1 Secalis	on Rye.
	2 Tritici	on Wheat.
	3 Agropyri	on T. repens.
	4 Bromi	on B. arvensis, &c.

P. simplex Körn.	- - - -	on Barley.
P. coronifera Kleb. (Æc. Cathartici)	1 Avenæ	on Oat.
	2 Alopecuri	on A. pratensis, &c.
	3 Festucæ	on F. elatior.
	4 Lolii	on L. perenne
	5 Glyceriæ	on G. aquatica
	6 Holci	on H. lanatus and H. mollis
P. coronata Corda. (Æc. Frangulæ)	1 Calamagrostidis	on C. arundinacea.
	2 Phalaridis	on P. arundinacea.
	3 Agrostidis	on A. vulgaris, &c.
	4 Agropyri	on T. repens.
	5 Holci	on H. mollis and lanatus

REV. CANON DU PORT.

Another of the older generation of British Mycologists has passed away in the person of the Rev. Canon Du Port, who died at *Denver* Rectory, in the County of *Norfolk*, on 21st February, 1899. James Mourant Du Port, the son of James Du Port, Assistant Treasurer of the States of *Guernsey*, was born at *St. Peter's Port* on 14th April, 1832. He was educated at Elizabeth College, from whence he obtained a scholarship at Caius College, *Cambridge*. He took his B.A. in 1855, being tenth wrangler and subsequently became Dean of his College. He was Hebrew Lecturer from 1855 to 1862. In the latter year he was appointed to the vicarage at *Mattishall*, where he remained till 1884, when he became Rector of *Denver*. In 1881 he was made Honorary Canon of *Norwich* and in 1890 Rural Dean. Throughout his life he was keenly interested in Natural Science. For a long series of years he conducted meteorological observations both at *Mattishall* and *Denver*. His greatest pleasure, however, was in the study of botany. Not only did he possess a sound practical knowledge of the phanerogams of his own country, but also the floras of *France* and *Switzerland*, as well as that of *Egypt*, received his attention. He was best known however as a fungologist, and for many years was a regular attendant at the Fungus Forays of the Woolhope Club, of which Field Club he was an honorary member. His knowledge of Latin was greatly appreciated by his fellow-members, and it was always at their service, for he spared no trouble in unravelling the intricacies of the descriptions of the "*Hymenomycetes*" and "*Monographia*." Always ready to help, his genial manner and kindheartedness made him a universal favourite amongst the Woolhopians. For many years he was a member of the Société Mycologique de France, and attended several of the forays, notably in 1887, 1891 and 1896, where his knowledge of the French language stood him in good stead, for he was as much appreciated there as here. Mainly interested in the Hymenomycetes there was nothing in the shape of a fungus which came amiss to him. One of the species found by him at *Mattishall*—*Russula Du Portii*—was named after him; it is figured in Cooke's Illustrations, pl. 1,042.

He contributed the following papers:—

"On some species of Tricholoma not easily distinguished," Wool. Trans., 1883.

"On the colours of the fungi as indicated by the Latin words used by Fries," Ib., p. 113.

"The unexpected appearance of two species of fungi in a field quite recently under cultivation," Ib. 1890, p. 122.

"On the Fungoid diseases of Cereals," Norf. and Norw., Trans. 1880, p. 194.

"On some of the rarer fungi found near *Mattishall* in 1880," Ib., p. 200.

"On a remarkable appearance of fungi," Ib. 1893, p. 558.

Many sorrowing friends attended the funeral, amongst whom were the Bishops of Norwich and Thetford and our President, Dr. C. B. Plowright, his medical attendant.

MR. H. T. SOPPITT.

On April 1st, 1899, died at his residence, 12, Glen View, *Halifax*, Henry Thomas Soppitt, who succumbed, after an illness of a fortnight, to an attack of pneumonia. Born in *Bradford*, June 21st, 1858, he was only in his 41st year when he was taken from us, leaving the world poorer by the loss of an original worker in that department of natural science in which he had made for himself a name. The subject of the present notice possessed that untiring energy and never flagging perseverance which are so essential to those who would unravel the secrets of Nature. A Yorkshireman by birth, he possessed the genial *bonhomie* and warm-heartedness of his race, tempered by a natural diffidence of manner that made it impossible for him to hurt the feelings of anyone. Brought up in his father's business, he resided in *Bradford* until 1894, when he removed to *Halifax*. Compelled to earn his living by an uncongenial and poorly-remunerative occupation, he managed to acquire an all-round knowledge of natural history; entomology, geology, zoology, and botany were alike to him the objects of study and the sources of enjoyment. Devoid of personal jealousy, and ever free to impart the information he possessed to others, it is no wonder he made many friends.

Fond as he was of all branches of natural history, it was as a botanist that he did his most brilliant work. Possessing a sound knowledge of the flowering plants of *Yorkshire*, he took a special interest in fungi. Some ten or twelve years ago he began the biological study of the Uredineæ, and it is from his experimental researches that we know the life-history of the several species which had previously either been shrouded in mystery or wrongly interpreted. For instance, prior to his work, the Puccinia and Æcidium on Adoxa Moschatellina

were regarded as being stages of the same species, but he demonstrated that the Puccinia is a Micropuccinia, and has no relation to Puccinia albescens, which is an Auteupuccinia with Æcidium, Uredo, and teleutospores on the same host-plant. He then cleared up the life-history of Æcidium leucospermum, showing it to be an Endophyllum. He found its spores germinated as those of Endophyllum do, and that while they were without effect upon adult plants, yet seedling Anemones became affected with the Æcidium after infection, and that the fungus had nothing whatever to do with the Puccinia fusca which occurs on the same host-plant. It fell to his lot to be the first person to demonstrate a heteræcious Puccinia which has its Æcidiospores on a Dicotyledon; this he did in working out the life-history of P. Bistortæ, by proving that its Æcidiospores occur on Conopodium denudatum. He attacked that complicated problem, the life-history of the Pucciniæ on Phalaris arundinacea, proving that the Æcidium on Lily of the Valley belonged to one of them, which he named P. digraphidis, thereby opening a discussion amongst continental botanists as to the relative value of these specific forms, which has hardly yet been concluded. Lactarius involutus, Sopp., is figured in Cooke's *Illustrations*, t. 1,194. Dasyscypha Soppittii, Mass., is named after him, as also is the genus Soppittiella, one of the Thelephoreæ. His last paper in conjunction with Mr. Crossland appeared in the January number of the *Naturalist*, and contained descriptions of several new species of Discomycetes. He was present at the last meeting of the British Mycological Society, of which he was one of the original members, last October, in *Dublin*. He was in excellent health, enjoyed the meetings and excursions, and the meeting of old friends. From what fell from him there, it was evident that a somewhat lengthy visit to *Switzerland* in 1897, with his friend Mr. H. A. Pawson, where he found an opportunity of studying the Swiss flora, was one of the red-letter periods of his life. He was buried at *Ecclesbill* on April 4th, when most of the leading Naturalists of *Yorkshire* were present. He left a widow and four children to mourn his loss.

Mr. Soppitt wrote many interesting Botanical papers, amongst which we may enumerate—

1883—Fungus Foray of the Woolhope Club. The Naturalist, Nov., 1883, pp. 61-63.

1884—Poisonous Fungi. Gardeners' Chronicle, 15 Nov., 1884, p. 629.

1888—Yorkshire Fungus Foray. Gard. Chron., 13 Oct., 1888, p. 420.

1890—Puccinia digraphidis, Sopp. Journal of Botany, July, 1890, pp. 213-216.

1890—Lily of the Valley Fungus. Gard. Chron., 24 May, 1890, p. 643.

1891—Doncaster Fungus Foray. Naturalist, Nov., 1891, pp. 339-348.

„ —Strobilomyces strobilaceus in South-west Yorkshire. Naturalist, Dec., 1891, p. 353.

„ —Additions to West Yorkshire Fungi. Naturalist, Sep., 1891, pp. 279-282.

1892—A Mycological ramble in mid November. Naturalist, Jan., 1892, p. 16.

1893—Æcidium leucospermum D.C. Journal of Botany, Sep., 1893, pp. 273-274.

„ —Some observations on Puccinia Bistortæ Str. Grevillea, Dec., 1893, pp. 45-47.

1894—Botanical Rambles about Arnside. Naturalist, Sep., 1894, pp. 265-267.

„ —Clavaria fusiformis in Westmoreland. Naturalist, Nov., 1894, p. 348.

1897—Bermerkungen uber Puccinia Digraphidis Sopp. Zeitschrift fur Pflanzenkrankheiten, 1897. Bd. 8, p. 8.

1898—The Gooseberry Fungus Æcidium grossulariæ. Gard. Chron., 20 Aug., 1898.

1899—New British Fungi found in West Yorkshire. Naturalist, January, 1899, p. 27.

By the kindness of the Editor of "The Gardeners' Chronicle" we are enabled to place before our members the accompanying portrait.

The following Members have joined the British Mycological Society during the Season 1897-1898.

Francis Mr. George E., M.D., 79, Elm Street, Worcester, Mass., United States of America.

Gardner Mr. Fred, 11, Nevill Street, Abergavenny.

Hughes Mr. G. C., Chesterton, Bicester, Oxfordshire.

Johnson Professor T., D.Sc. Science and Art Museum, Kildare Street, Dublin.

Montague Mrs. L., Penton, Crediton, N. Devon.

Pipe Mr. Charles E., Broad Street, Worcester.

Ramsay Mr. A., 4, Cowper Road, Acton, London.

Smith Miss Annie Lorrain, of the Cryptogamic Department, Herbarium, British Museum, S. Kensington, London.

Stretton Mr. A., 17, The Tything, Worcester.

Swanton Mr. E. W., The Educational Museum, Haslemere, Surrey.

OFFICERS FOR THE SEASON 1897-1898.

President - - -	George Massee, F.L.S., Royal Herbarium, Kew.
Acting President - -	Charles B. Plowright, M.D., King's Lynn.
Hon. Sec. & Treasurer-	Carleton Rea, B.C.L., M.A., 34, Foregate Street, Worcester.

PIMINA PARASITICA W.B.G.

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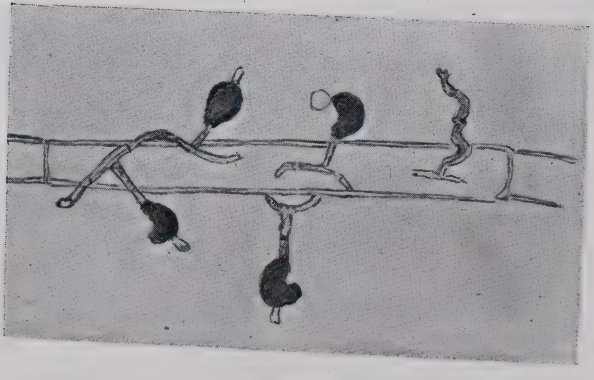

G. Pim. delt.

PIMINA PARASITICA W.B.G.

CBP. ad nat. del.

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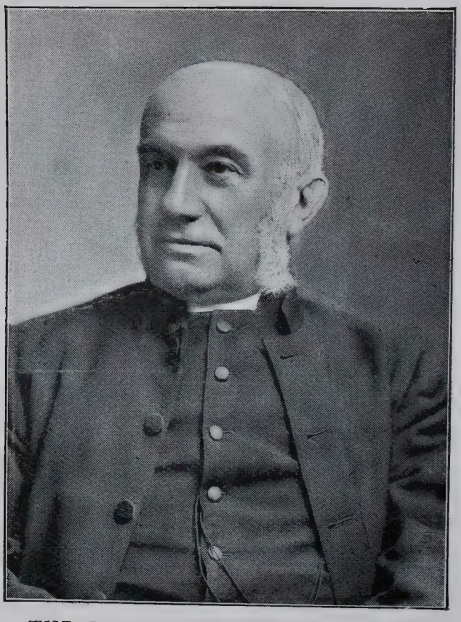


THE LATE REV. CANON DU PORT.

THE LATE MR. H. T. SOPPITT.

THE NEW FOREST FORAY.

2nd–7th October 1899.

The third annual week's fungus foray was held in The New Forest, where the members assembled on the evening of Monday, the 2nd of October, at the Crown Hotel, Lyndhurst, under the Presidency of Mr. C. B. Plowright, M.D., who exhibited, on behalf of Mr. W. Phillips, F.L.S., some fine examples of *Geaster limbatus* Fr., and the Rev. W. L. W. Eyre placed out on exhibition a lovely specimen of the excellent esculent *Amanita strobiliformis* Vitt. from North Hants, where he said it was common.

On Tuesday, the 3rd of October, the members proceeded, under the conductorship of their member, the Rev. W. L. W. Eyre (who is intimately acquainted with the Forest and had kindly arranged the details of the different days' forays) to the Woodlands enclosure, where amongst the pines a good crop of fungi were found. These included *Tremellodon gelatinosum* Pers., *Rhizopogon rubescens* Tul., *Polyporus spongia* Fr., *P. amorphus* Fr., *Boletus candicans* Fr., *B. duriusculus* Schulz., *Mycena Iris* Berk., and *Lactarius theiogalus* Fr. The Club dinner was held in the evening at The Crown Hotel, after which the election of officers and other business was proceeded with. Professor H. Marshall Ward, M.A., F.R.S., F.L.S., was unanimously elected President, and Mr. Carleton Rea, B.C.L., M.A., Hon. Secretary and Treasurer. Mr. Rea reported that he had enrolled 4 new members, whilst they had lost, by death, 2 eminent members during the year, The Rev. Canon Du Port and Mr. H. T. Soppitt, and one member, Mr. J. W. Sutcliffe of Halifax, had resigned. The accounts showed an adverse balance of £3. 10s. 5d., but against that amount there were outstanding subscriptions due and unpaid of over £6, and some numbers of the *Transactions* for sale. The invitation of the Cryptogamic Society of Scotland to join their meeting next year at *Rothiemurchus* was unanimously accepted, whilst the invitations of The South Eastern Union of Scientific Societies and others were held over for further consideration at the next meeting.

On Wednesday, the 4th of October, the members explored the Forest, going through the beech woods on either side *via* Lyndhurst Hill to Allum Green, returning home by the Christchurch Road,

whilst a few members made a detour through a pine plantation. The most noticeable species included *Mycena aurantio-marginata* Fr., *Boletus aereus* Bull., *Sparassis crispa* Fr., and *Poronia punctata* Fr. In the evening Mr. C. B. Plowright, M.D., delivered his presidential address, entitled "Recent additions to our knowledge of the Uredineæ" (see p. 90). and Dr. M. C. Cooke sent a poetic welcome to his fellow-members, including a long enumeration of mycologists and their doings for some years past, which was much appreciated.

On Thursday, the 5th of October, the Rev. W. L. W. Eyre led the members again to Allum Green, and the Forest further away from Lyndhurst was explored, the members returning by the Ringwood Road, Emery Downs, to Lyndhurst, but only *Polyporus spumeus* Fr. and *Russula chamaeleontina* Fr. are worthy of note. In the evening, papers were read by Mr. Charles Crossland, F.L.S., on "Mollisia cinerea and its varieties" (see p. 106); Mr. T. Howse, F.L.S., "Notes on fungi in the Alps," and the Rev. W. L. W. Eyre, "Notes on Hampshire Fungi" (see p. 110); he also most generously distributed to the members "A list of fungi found in the County of Hants," which he had specially compiled for the use of the members of the British Mycological Society attending this Foray. The list includes over 580 species of the Basidiomycetes, and Mr. Eyre must be congratulated on the accuracy of his work, seeing that only 46 species were added to that list during the week's foray by all the members, whilst 221 species enumerated therein were confirmed.

On Friday, the 6th of October, the enclosures of Boldre Wood, Mark Ash, and Knight Wood were investigated, but time did not allow of the complete investigation of the latter. A fine specimen of *Polyporus Schweinizii* Fr. was gathered, and also many examples of *Gomphidius gracilis* Berk. and *Russula azurea* Bres.

On Saturday, the 7th of October, Knight Wood was further explored and its giant oak visited during the morning, where two rare Hydneæ were found, namely, *Hydnum Queletii* Fr. (first record for Britain) and *Hydnum cyathiforme* Schaeff., and specimens of *Poria umbrina* Fr. and *Tremellodon gelatinosum* Pers. were gathered. Many of the members had now departed home, but those remaining in the afternoon had an enjoyable drive to the picturesque ruins of Beaulieu Abbey.

List of the more uncommon fungi observed during the Foray:—

Amanita spissa Fr.
Tricholoma sejunctum Sow.
flavobrunneum Fr.
albobrunneum Pers.
imbricatum Fr.
acerbum Bull.
Collybia nitellina Fr.
ambusta Fr.
Mycena aurantiomarginata Fr.
Iris Berk.
capillaris Schum.
Entoloma lividum Bull.
Leptonia formosa Fr.
Pholiota radicosa Bull.
Stropharia squamosa Pers. var.
aurantiaca Cke.
Cortinarius (Myxacium) collinitus Fr.
(Dermocybe) lepidopus Cke.
miltinus Fr.
raphanoides Pers.
(Hygrocybe) castaneus Fr.
Gomphidius roseus Fr.
gracilis Berk. & Br.
Hygrophorus cossus Fr.
miniatus Fr.
Lactarius insulsus Fr.
pallidus Fr.
theiogalus Fr.
fuliginosus Fr.
serifluus Fr.
Russula caerulea Fr.
lactea Fr. var. incarnata Quél.
azurea Bres.
consobrina Fr. var. intermedia Cke.
chamaeleontina Fr.
Lentinus cochleatus Fr.
Boletus flavidus Fr.
tenuipes Cke.
bovinus Linn.
variegatus Sow.
calopus Fr.
candicans Fr.
aereus Bull.
purpureus Fr.
duriusculus Schulz.
Polyporus Schweinizii Fr.
intybaceus Fr.
spongia Fr.
amorphus Fr.
spumeus Fr.
Fomes applanatus Wallr.
Poria umbrina Fr.
Hydnum Queletii Fr.
cyathiforme Schaeff.
Irpex obliquus Fr.
Radulum orbiculare Fr.
Grandinia granulosa Fr.
Peniophora gigantea Mass.
Coniophora sulphurea Mass.
Sparassis crispa Fr.
Calocera stricta Fr.
Tremella intumescens Eng. Bot.
Tremellodon gelatinosum Pers.
Rhizopogon rubescens Tul.
Uredo Mülleri Schröt.
Phragmidium albidum Kühn.
Orbilia luteorubella Karst.
Dasyscypha calycina Fckl.
Ciboria echinophila Sacc.
Nectria inaurata B. & Br.
Poronia punctata Fr.
Quaternaria Persoonii Tul.
conidial form.
Schirrhia rimosa Fckl., Pycnidia on Arundo phragmitis.

ON THE RECENT ADDITIONS TO OUR KNOWLEDGE OF THE UREDINEÆ AND USTILAGINEÆ WITH SPECIAL REFERENCE TO THE BRITISH SPECIES.

BY CHARLES B. PLOWRIGHT, M.D.

PRESIDENTIAL ADDRESS.

JUST ten years ago, a monograph of these fungi was published, but since then so many and so active have been the workers in this particular branch of study that it is essential for us to have an outline of what has been done if we would not be entirely left behind the times in matters mycological. Klebahn and Dietel in Germany, Fischer in Switzerland, Eriksson in Sweden, Rostrup in Denmark have year after year added fresh facts to our store of knowledge, while Magnus as vigorous as of yore, Hartig, Juel, Chodat, Tranzschel, Henning, Lagerheim, De Toni, Pazschke, Brefeld, Setchel, Kühn Cocconi, Richards, Swingle, Wagner, Bubak, Marshall Ward, Barclay, Jacky and others have each added their modicum. Nor are we likely to forget our friend the late Mr. H. T. Soppitt, who was with us at our last meeting and to whom we owe so much. We can but regret he was never in a position during his short but active life to have devoted his whole energies to this subject, in which case we should not have needed to have gone abroad for the elucidation of so many life histories.

These fungi constitute such an economically important group of the Basidiomycetes that it is not surprising they should have received so much attention. The remarkable character some of them possess of changing their host from one species of phanerogam to another has no doubt been the attraction to many biologists to investigate their development.

When in 1864 De Bary announced in his now classical paper that the Æcidium on barberry was but a stage in the life cycle of *Puccinia graminis* and in 1865 that *Aecidium asperifolii* and *Aec. rhamni* were similarly related to *Puccinia rubigo-vera* and *coronata* it was thought that the life-history of the cereal rusts was settled and done with and that the number of species of the Uredineæ was wonderfully reduced. One or two carping critics would however persist in pointing out that the whole matter was not cleared up quite so completely ,that for instance there were certain districts in England from which the barberry was absent but where from time to time the wheat crop was seriously injured, nay further there were countries, in some of our colonies especially, in which no barberry grew but in which more damage was done to the wheat crop than was even the case in those parts of Europe, where the shrub is comparatively common.

We now know of course both groups of facts are perfectly true, and although we are unable completely to explain every detail of either, it only remains for us to work on steadily accumulating information, piling together observations, and if we only go on long enough we shall in due time understand the whole question. We got but little light on this wheat mildew problem until Eriksson in 1894 showed us that the so-called *Puccinia graminis* represents a number of biological species: all of which have their æcidiospores on the barberry but their other spore forms on certain groups of grasses. For instance the uredospores on wheat cannot be made to grow upon *Triticum repens*—although the *Triticum repens* uredospores will infect barley and rye. A keen discussion at once arose as to whether these different forms should be called species, varieties, sister-species or forms, what we decide to call them really does not matter very much. A great deal will depend upon the standpoint from which they are regarded, if from an herbarium-standpoint they are not species in as much as one can find no tangible difference in appearance, size, colour, and form of their respective spores. But judging a fungus by its spores alone is something akin to judging a flowering plant by its seed. A practical seedsman can distinguish rape from mustard or turnip seed but for all that he generally protects himself by declining to guarantee, on the label of the parcel he supplies you with, that the seed sold will produce the desired crop. On the other hand those interested in plant diseases who look at the matter from a laboratory-view-point when they find one fungus on wheat and another on *Triticum repens* which, although they are indistinguishable by the eye, yet cannot be made to interchange hosts: they naturally regard them as

distinct species. The simplest way seems to call them biological species and have done with the controversy.

The facts involved are, however, of great practical importance—for instance, adjacent crops of wheat and rye, or of wheat and oats or barley may be grown without fear of infecting one another: nor need the proximity of *Triticum repens* or *Poa* in the hedge banks be dreaded as sources of infection. During the present year I have performed some experiments with *Puccinia graminis* which may be worth recording in so far as they corroborate Eriksson's statements and show that the results obtained by him hold good in this country.

Early in the year my friend Mr. F. Barrington kindly obtained for me a supply of over-wintered *Puccinia graminis* on *Poa trivialis* from Narborough near King's Lynn. The spores were found to germinate freely, and on the 6th May Mr. K. B. Williamson and myself applied them to a small barberry bush in my garden; in due course the pycnidia appeared, and on the 10th of June perfect æcidiospores were developed, on this day these æcidiospores were applied to a series of plants growing in pots, viz: *Poa trivialis*, *Triticum repens*, barley, rye and oats. On the 9th of July the uredo appeared on the Poa but not on any of the other plants. In order that they might have a fair chance of being infected they were planted in a circle round the barberry, which was just a small bush not more than a foot in height. They were thus not only exposed equally to the æcidiospores but also to the uredo spores, which had already formed on the *Poa*. From time to time these plants were examined until they were finally pulled up on the 15th of September; at which time careful examination showed them to be fungus-free with the exception of the Poa, on which teleutospore beds were present. Thus Eriksson's statement is absolutely confirmed as to the species on *Poa*, being biologically distinct from those on oat, barley, *Triticum repens* and rye.

Æcidiospores on Berberis vulgaris from	Plant Infected.	Date.	Date of first result.
1304. Poa trivialis	Poa trivialis	18 June	9 July.
1305. "	Triticum repens	18 June	—
1306. "	Hordeum vulgare	18 June	—
1307. "	Avena sativa	18 June	—
1308. "	Secale cereale	18 June	—

Further cultures were also made on 18th June by applying the uredospores on *Triticum repens* to another series of pot plants viz: *Tr. repens*, barley, wheat, rye, oat and *Poa trivialis*. On the 3rd August the *Triticum repens* had well developed uredospore beds but the other plants remained free. On the 15th September these plants were gathered and carefully ex-

amined, soon after infection, these plants like those in the previous series had been planted out in the garden. Each pot contained about six seedlings of each of the cereals.

	Uredo graminis from	Plant Infected.	Date.	Date of first result.
1310.	Triticum repens	Triticum repens	18 July	3 August.
1311.	„	Hordeum vulgare	18 July	—
1312.	„	Secale cereale	18 July	—
1313.	„	Avena sativa	18 July	—
1314.	„	Triticum vulgare	18 July	—
1315.	„	Poa trivialis	18 July	—

It would appear then that our English fungi are even more fastidious in their tastes than the Swedish for Eriksson finds that the form on *Triticum repens* is also capable of affecting both rye and barley. Of course the negative result I obtained cannot be seriously compared with the hundreds of experiments which Eriksson and Henning have conducted.

There is one error into which my continental friends have fallen about myself that I should like to take this opportunity of correcting. They consider that I have succeeded in producing the *Uredo graminis* on wheat from sowing the sporidia (promycelial spores) on wheat: this is a mistake I have never done so. It is true that in my first series of cultures made in 1883 *Uredo graminis* appeared on some wheat plants to which the germinating teleutospores had been applied, but the plants had not been protected from external (atmospheric) infection and even grown in a small garden in which a great number of other wheat plants were growing all of which that year became sooner or later attacked by the disease. In the following year I repeated the experiment taking care to keep the infected plants continously covered by a bell-glass and of course obtained negative results.

One of the tangled problems in the heteroecious Pucciniæ is presented by that group which forms its teleutospores on *Phalaris arundinacea*. Just as the barberry seems to be the common home for the æcidiospores of a whole host of biological species of which *P. graminis* is the type: so *Phalaris arundinacea* is the teleutospore-host for an extensive group of species of the *P. sessilis* type, having their æcidiospores on many plants, viz.: *Allium ursinum*, *Convallaria majalis*, *Arum maculatum* and *Paris quadrifolia*.

Dr. Klebahn has for some years conducted a long series of cultures with the view of determining the stability of these species. In the subjoined tabular summary, which he has obligingly sent me, of the results he has obtained of our state of knowledge of the subject up to date is shown.

Ædicial Host-plant.	Teleutospore.	Dr. Klebahn's Remarks.
Arum maculatum, L.	P. phalaridis Plow. = P. ari-phalaridis, Kleb.	A distinct species, as shown by experimental cultures of Dietel, Klebahn, and Plowright.
Allium ursinum, L.	P.sessilis Schneider = P.winteriana. Magnus = P. allii-phalaridis, K.	
Maianthemum bifolium Schm. Polygonatum multiflorum, All. " verticillatum, All. Convallaria majalis, L. Paris quadrifolia, L.	P. sessilis Schneider in part = P. smilacearum-digraphidis, K.	A distinct species.
Convallaria majalis, L.	P. digraphidis, Sopp = P. convallariæ-digraphidis, K.	From the experiments of Klebahn and Soppitt, this species appears distinct from the preceding, but it possibly may have developed from it, and therefore may be regarded as a sub-species.
Paris quadrifolia, L.	P. paridis, Plow = P. paridis-digraphidis, K.	Distinct, according to Plowright, from P. convallariæ-digraphidis, but as it may possibly have developed from P. smilacearum-digraphidis, it may be considered as a sub-species.
Leucojum æstivum, L.	P. schmidtiana, Dietel.	Most probably a distinct species, but not yet proved so by serial cultures.
Orchis maculata, L. latifolia, L. Platanthera bifolia, Reich. chlorantha, Ceut. Listera ovata, R. Brown.	P. orchidearum-phalaridis, K.	A distinct species, according to Klebahn's cultures, but it has as yet only been found by him growing naturally in company with P. convallariæ-digraphidis and P. smilacearum-digraphidis. Further cultures are desirable.

In order to test the stability of the species Klebahn has since 1892 conducted a series of cultures in which the æcidiospores from one species of host plant have been year by year sown on other host plants known to harbour the parasite. *P. smilacearum-digraphidis* has been the species selected which as will be seen from the table has its æcidiospores on five plants viz.: Maianthemum bifolium, Polygonatum multiflorum, P. verticillatum, Convallaria majalis and Paris quadrifolia. The æcidiospores from Polygonatum only were employed, these were placed on Phalaris and the resulting P. teleutospores next year applied to the above named plants: from the resulting æcidia only those on *Polygonatum* were again used, and so on. In 1895 the æcidia were less abundant and only poorly developed on Paris. In 1897 none were formed on Paris at all, and it has failed to develope the parasite since, at the same time the fungus was not so well developed on Maianthemum, and in the following year Convallaria was not so freely infected; while all through the series the *Polygonatum* plants produced the æcidia most freely and most perfectly. This looks as if there were a tendency for the species to become specialised on one particular host, although the results obtained were not absolute.

Klebahn found that the common æcidium on Orchis latifolia was connected with a Puccinia on Phalaris *(P. orchidearum-phalaridis K.)* Originally Rostrup led us to believe that the orchid æcidium was connected with the Puccinia on Molinia cærulea: but from several experiments I have made at King's Lynn it was apparent that our æcidium on *Orchis latifolia* had some other life history. Accordingly, I determined to repeat Klebahn's cultures upon *Phalaris* with it. A supply of the *Phalaris* having been obtained from Barton Broad from a place near which none of the other host plants except the orchis grew. The teleutospores were this year germinated and applied to a series of plants viz.: *Orchis latifolia, Arum maculatum, Allium ursinum* and *Convallaria majalis* on 10th May. On the 19th yellow spots were observed on the orchid followed in a few days by pycnidia. No effect was observable on the other plants—but after a short time certain pale spots were observed on the *Convallaria* which by the 20th were so evident as to be unmistakeable. (The specimen I now shew you). These spots hardly look like at first sight as if they were due to the growth of the parasitic mycelium of a uredine, for although there is a change of colour in the chlorophyll, yet there is no thickening of the tissues as is the case when these mycelia are present, in fact if the leaf be held up to the light it will be seen that the chlorophyll colour has been discharged: the mesochlorophyll is gone and but little else left except the epidermis of the upper and

lower leaf surfaces. That this result was due to the teleutospores there cannot be much doubt as the infected plant was one of some dozens on none of which were any similar decoloration observable although careful search was made.

The æcidiospores on the orchis were mature early in June and on the 16th were applied to two healthy plants of *Phalaris arundinacea* which on the first July had uredo spore sori developed on them.

1251.	Puccinia orchidearum — phalaridis K.	}	Orchis mascula ?	31 March	
1276.	"	"	" latifolia	10 May	19 May
1277.	"	"	Arum maculatum	10 May	
1278.	"	"	Allium ursinum	10 May	
1279.	"	"	Convallaria majalis	10 May	28 May
1302.	Æcidium orchidis		Phalaris arundinacea	16 June	1 July
1303.	"	"	" "	16 June	1 July

In 1866, Œrsted, of Copenhagen, showed that the three common *Gymnosporangia* were connected with the three common *Ræstelia*. Subsequent work showed the existence in England of a fourth species *G. confusum*, while on the Continent Hartig has demonstrated the association of a fifth G. *tremelloides* with the *Ræstelia* on the apple. These last two species are found to have these Æcidiospores on several hosts. So far *G. tremelloides* has not been recorded in Britain, but its existence is worth bearing in mind.

After the lapse of eight years, Wolff showed the connection between *Peridermium pini* and *Coleosporium senecionis*. Between the years 1881 and 1888 I repeated Wolff's experiments of putting the spores of *Peridermium pini* on *Senecio* eleven times, once only with success. The problem was attacked by Klebahn, who showed that other *Coleosporia* besides *C. senecionis* had their æcidiospores on *Pinus sylvestris:* his work has been supplemented by E. Fischer. The result of their investigations will be found in the appended list of British Uredineæ.

As early as 1883 Rostrup and Nielsen pointed out the connection between the Cœomata and the Melampsoræ, and I attempted the repetition of their work, but with little success. I did succeed in producing *Cœoma mercurialis* on *M. perennis* from a Melampsora on Poplar, but I was misled as to the species of poplar, being unfortunately told by the late Mr. B. Acton that it was *P. alba*, whereas the leaves in question subsequently proved to be those of a young plant of *P. tremulæ*, he having been misled by their pubescence. Hence I erroneously referred the *Melampsora* to *M. æcidioides*. I am glad of the present opportunity of correcting my error. In 1888 I worked out the life history of the *Cœoma* on *Orchis maculata*, but it was not until the present year that I have

been able to confirm Rostrup's statement that *Cæoma Euonymi is* related to the *Melampsora* on *Salix cinerea*. This I was enabled to do by the kindness of my friend, Mr. E. J. Tatum, of Salisbury, who took me in June last to a locality near that city, where we were able to gather a few specimens of the *Cæoma*. Although the season was rather advanced, yet I applied these to a plant of *Salix cinerea*, which I had growing in my garden, with the satisfactory result of producing the uredospores in question.

Mr. Tatum has further been fortunate enough to find *Cæoma confluens* on *Ribes grossuluria* in the near neighbourhood of a number of Salices. I have therefore hope, at some future time, to confirm Rostrup's and Nielsen's statement that this fungus is connected with one of the *Melampsoræ*. These two cultures would be particularly interesting to me since many years ago I attempted their performance with teleutospores of certain Melampsoræ, collected in Norfolk, but with absolute non-success. We have here, then, one other instance of the complexity of the life histories of the Uredineæ, and again have to decide whether they be species or spore-forms that we are dealing with.

I must briefly allude to the life history of one of our commonest Melampsoræ, namely, that on Birch. As will be seen by the table, *Cæoma laricis* has been found to consist of a host of different species, on poplar, aspen, and various willows. As it occurs with me, I find it, as I have elsewhere shown, related to *M. betulinæ*, and as far as my cultures have hitherto gone, with nothing else, with one exception. Klebahn considers that the microscopic structure of my Larch-birch Cæoma is so distinct from the Larch-poplar and Larch-willow species as to merit placing it in a genus by itself on account of degree to which its peridium cells are developed; in fact, it is an Æcidium rather than a Cæoma. He proposes to call it *Melampsoridium betulinum*.

The exceptional case was a culture I made this year with some teleutospores on the leaves of *Populus alba* Mr. Tatum sent me from near his residence. In this case the germinating teleutospores gave rise to yellow spots, which proved on microscopic examination to be pycnidia on *Larix Europaea;* but, unfortunately, the plant died before the fungus had time to develop. This was the only successful result I obtained from seven cultures of Melampsora on *Populus alba*. In the appended list of the British Melampsoræ it is remarkable how many have their Cæomata on Larch. On the Continent the Cæomata of *Melampsora tremulæ* occur on Larch, *Mercurialis perennis*, *Chelidonium majus*, *Pinus sylvestris*, and *Corydalis sp.*

Melampsora pustulata, or as it is more commonly now called, *Pucciniastrum pustulatum* (Pers.), a species not very uncommon in some parts of the country, has been shown by Klebahn to have its æcidiospores on *Abies pectinata*, a not very abundant tree with us.

It would be very desirable to see if the same life-history holds good with us as with him.

The teleutospores of *Uredo agrimoniæ*, a very widely distributed species occurring not only in Europe but also in Asia, Africa and America, have been found to consist of extra-cellular bodies divided into four compartments by two septa at right angles to one another, one longitudinal the other transverse, and is placed by Dietel in this genus. *(Pucciniastrum.)*

Æcidium leucospermum on the wood anemone Mr. Soppitt shewed to be an *Endophyllum*; its spores germinate as do those of the other *Endophylla* and infect young seedling plants only.

Uredo scolopendri Fckl, for which the late Dr. Buchanan White* made the genus Milesia (after the Rev. Miles Joseph Berkeley), is a very interesting fungus; its Uredo spores which are colourless are contained in a conceptacle placed just beneath the cuticle of the plant. They escape through an apical opening, while the teleutospores are formed in smaller clusters more deeply buried in the tissues of the host-plant. Magnus proposes the genus *Urediniopsis* for it. It is not uncommon in this Country on various ferns, *e.g.*, *Scolopendrium*, *Blechnum* and *Polypodium vulgare*.

Colourless æcidiospores besides those of *Endophyllum leucospermum* occur on the Rumices, but the most remarkable and peculiar are those belonging to *Puccinia vincæ*. The Æcidium itself is not cup-shaped, but consists of a round flat somewhat raised cushion-shaped black mass upon the upper surface of which the colourless Æcidiospores, are produced in chains. At first sight, the structure looks more like a *Coryneum* than an Æcidium.

Phragmidium albidum is a fungus we should look for on the various bramble leaves. It was originally described by Kühn as a *Chrysomyxa*. The *Uredo Mülleri* of Schröter is regarded as connected with it: this is an autumnal species with pycnidia, on circular spots. The teleutospores occurred this year at North Wootton, near King's Lynn, and were met with yesterday in the New Forest.

Uredo Chrysanthemi. In 1897 the Chrysanthemum growers of England were alarmed by the appearance of a Uredo on this plant, which like all newly introduced species, spread with great rapidity. In an article on the disease not only were the teleutospores duly figured, but growers were warned of the danger of allowing wild Compositæ, such as Hawkweed, and Burdock, to grow near their Chrysanthemums.

In order to test the truth of this warning, on the 23rd. October, 1898, germinating spores of the Uredo were applied to *Hieracium aurantiacum*, *Taraxacum officinale* and *Chrysanthemum uliginosum*, but without effect.

* B. White. Scottish Naturalist, 1878.

The spores of this *Uredo chrysanthemi* placed in water germinated in a few hours with great vigour. In the course of 24 hours so energetic was the growth of their germ-tubes that they intertwined with one another so that the mass of spores, floating on the culture drop looked for all the world as if it had become mouldy, but the apparent hyphæ were only germtubes. If the spores, which are globose, be allowed to become dry and are examined microscopically in that state it will be seen that one segment of the sphere is very much stronger than the rest, so that the spores collapse laterally in such a way as to resemble those indigo-balls sold by grocers under the name of "thumb blue" and used for laundry purposes. Each spore looks as if it had been compressed on one side between the finger and thumb.

With regard to the Ustilagineæ the same differentiation of species on biological grounds has been demonstrated, only in these cases corresponding morphological characters usually co-exist. The work of Jensen, Brefeld, Swingle, Kellerman, Magnus, Dietel, Cocconi, Kühn, &c., is recognised by all. The old species Ustilago segetum is now known to comprise

Ustilago tritici (Pers.) on wheat.
„ hordei (Pers.) on barley.
„ nuda (Jens.) on barley.
„ perennans (Rost) on Avena elatior.

which differ not only in spore measurements, &c., but in the manner in which the spores germinate as well as in naked eye characters. For instance, the two barley species, one is firm compact and solid, while the other consists of an evanescent dusty mass. Jensen has further pointed out the existence of two species of Ustilago on the cultivated oat which although they have not yet been recognised as British probably occur with us. They are distinguishable by their naked eye characters inasmuch as one *U. avenæ* Pers. destroys the whole head as *U. nuda* on barley does: while the other U. *lævis* K. and S. does not destroy the outer paleæ. Besides this, the spores of one species are smooth but of the other rough.

Two well marked species of *Tilletia* have long been recognised on wheat, one with areolate, the other with smooth spores. Only the former has been observed in Great Britain but the existence of the other should be borne in mind.

The curious Ustilago which some botanists call *Schrœteria delastrina* in the interior of the fruit of *Veronica hederacea*, in which the twin spores form a striking feature, has been added to our flora as has also *Ustilago vaillantii* Tulasne which Mr. Greenwood Pim detected on the inflorescence of *Scilla bifolia* in April 1895. The last addition to this group of fungi is the curious *Urocystis filipendulæ* which Mr. Tatum detected on the foliage of *Spiraea filipendula* last year.

One experiment I have performed this year may interest you.

The generally accepted view as to the means by which the Ustilagineæ infect their host-plant is, that the parasite gains admission into the embryo, soon after the seed has germinated. This is the case with *Tilletia tritici*, *Ustilago avenæ*, *Ustilago nuda*, &c., and is indeed generally true. But it is not the way by which all species of Ustilago infect their hosts. For example I have long held the opinion, founded on certain experiments made some years ago, that *U. violacea* on the anthers of *Lychnis dioica* infected its host by the agency of insects, especially bees, which carried the spores directly from an infected, to a sound flower. During the month of June last, I transplanted a vigorous young plant of *L. dioica* affected with the Ustilago from a wood at East Winch, near King's Lynn, into my garden, and planted it in close proximity to a healthy plant of the same species which had been growing there since spring. The transplanted specimen survived the process of removal and produced a succession of smutted blooms. Towards autumn the healthy plant began to produce a few smutted blossoms, the majority of which were on the side nearest the diseased plant. Some of these blossoms I now exhibit. Some are healthy, some bear the Ustilago in their anthers and one branch has blossoms of both kinds.* This, I take it, conclusively demonstrates the truth of my contention that *U. violacea* does not enter the embryonic plant and grow upwards with it as many of the Ustilagineæ do, but that it is implanted directly into the inflorescence by insect agency.

UREDINEÆ. Tulasne.

UROMYCES Link.

I. Euuromyces. Schröter.

Auteuuromyces.

Uromyces fabæ (Pers.)
orobi (Pers.)
phaseoli (Pers.)
limonii (D. C.)
polygoni (Pers.)
trifolii (Alb. and Schw.)
geranii (D. C.)
betæ (Pers.)
valerianæ (Schum.)
chenopodii Duby
Uromyces parnassiæ (D.C.)
salicorniæ (D.C.)

Heteruromyces.

Uromyces dactylidis. Otth.
poæ Rabh.
lineatus (Desm.) = Æc. glaucis
junci (Desm.)
pisi (Pers.) ?

II. Brachyuromyces. Schröt.

III. Hemiuromyces. Schröt.

Uromyces scutellatus (Schrank)
anthyllidis. (Grev.)
rumicis (Schum.)

* During the following Spring, 1900, both plants produced nothing but smutted flowers.

Uromyces sparsus (Kze. and Schm.)
alchemillæ (Pers.)
alliorum. (D.C.)
ficariæ. (Schum.)
scillarum. (Grev.)

IV. Uromycopsis. Schröt.

Uromyces behenis. (D. C.)
scrophulariæ. (D. C.)
ervi. (Wallr)

V. Micruromyces. Schröt.

Uromyces ornithogali. (Wallr)
urticæ. Cooke?

VI. Lepturomyces. Schröt.

PUCCINIA. Pers.

I. Eupuccinia. Schröt.

A. Auteupuccinia. De Bray.

Puccinia galii. (Pers.)
asparagi D. C.
thesii (Desv.)
calthæ Link.
convolvuli. (Pers.)
gentianæ. (Strauss.)
silenes. Schröt.
porri. (Sow.)
prenanthis. (Pers.)
lapsanæ. (Schultz)
variabilis. (Grev.)
pulverulenta. Grev.
violæ. (Schum.)
albescens. (Grev.)
bupleuri. (D. C.)
pimpinellæ. (Strauss.)
apii. (Wallr.)
menthæ. Pers.
aegra. Grove.
primulæ. (D. C.)
soldanellæ. (D.C.)
saniculæ. Grev.
vincæ. (D. C.)

B. Heteropuccinia. Schröt.

Puccinia graminis. Pers.
coronata. Corda
coronifera. Kleb.
phalaridis. Plow.
dispersa. E. & H.
poarum. Nielsen.
arenariicola. Plow.
schœleriana. Plow. and Mag.
sylvatica. Schröt.
dioicæ. Magnus.
paludosa. Plow.
obscura. Schröt.
phragmitis. (Schum.)
trailii. Plow.
magnusiana. Korn.
scirpi D. C.
moliniæ. Tul.
bistortæ. D. C.
perplexans. Plow.
persistens Plow.
extensicola. Plow.
winteriana. Mag.
pringsheimiana. Kleb.
magnusii. Kleb.
agrostidis. Plow.
paridis. Plow.
digraphidis. Sopp.
orchidearum-phalaridis. Kleb.

II. Brachypuccinia. Schröt.

Puccinia suaveolens. (Pers.)
bullata. (Pers.)
hieracii. (Schum.)
centaureæ. Mart.
taraxaci. Plow.

III. Hemipuccinia. Schröt.

Puccinia polygoni. Pers.
tanaceti. (D. C.)
iridis. (D. C.)
oblongata. (Link.)
glumarum (Schum.)

Puccinia baryi. (B. and Br.)
pruni. Pers.
acetosa (Schum.)
argentata. (Schultz.)
anthoxanthi. Fckl.
oxyriæ. Fckl.
hydrocotyles. (Link.)
sonchi. Rob.
lychnidearum. Link

IV. Pucciniopsis. Schröt.

Puccinia liliacearum. Duby.
tragopogi. (Pers.)
smyrnii. Corda.

V. Micropuccinia. Schröt.

Puccinia betonicæ. (Alb. and Schw.)
campanulæ. Carm.
schneideri. Schröt.
ægopodii. (Schum.)
epilobii. D. C.
asarina. Kze.
paliformis. Fckl.
virgaureæ. (D. C.)
andersoni. B and Br.
umbilici. Gueo.
fusca. (Relhan.)
bunii. (D. C.)
thalictri. Chevall.
schroeteri. Pass.
fergussoni. B. and Br.
rhodiolæ. B. and Br.
adoxæ. D. C.
ribis D. C.
saxifragæ. Schlecht.
senecionis. Lib.
glomerata. Grev.

VI. Leptopuccinia. Schröt

Puccinia arenariæ. (Schum.)
chrysosplenii. Grev.
veronicæ. (Schum.)
valantiæ. Pers.
malvacearum. Mont.
circææ. Pers.
veronicarum. D. C.
glechomatis. D. C.
asteris. Duby.
millefolii. Fckl.
cardui. (Plow.)
buxi. D. C.
annularis. (Strauss.)

TRIPHRAGMIUM. Link.

Brachytriphragmium.

Triphragmium ulmariæ. (Schu.)
filipendulæ. (Lasch.)

PHRAGMIDIUM. Link.

Phragmidium fragariastri (D. C.)
sanguisorbæ (D. C.)
potentillæ. (Pers.)
tormentillæ. Fckl.
violaceum. (Schultz.)
rubi. (Pers.)
subcorticatum. (Schrank.)
rosae-alpinæ. (D. C.)
rubi-idææ (Pers.)
albidum. (Kuhn.)

XENODOCHUS. Schlecht.

Xenodochus carbonarius. Schlecht.
curtus. Cooke. ?

ENDOPHYLLUM. Lev.

Endophyllum. euphorbiæ. (D.C.)
sempervivi. (Alb. and Schw.)
leucospermum. (D. C.) Sopp.

GYMNOSPORANGIUM. Hedw.

Gymnosporangium sabinæ. (Dicks.)

Gymnosporangium confusum. Plow.
clavariaeforme (Jacq.)
juniperinum. (Linn.)

MELAMPSORA. Castagne.

I. Melampsora.

Melampsora helioscopiæ. (Pers.)
vernalis Nissl.
lini (Pers.)
farinosa. (Pers.)
larici-caprearum. Kleb=Cæoma laricis.
larici-epitea. Kleb. =Cæoma laricis.
mixta. (Schlecht.)
hartigii Thum.= Cæoma grossulariæ.
vitellinæ. (D. C.)
tremulæ. Tul.= Cæoma laricis.
ædidioides. (D. C.)
rostrupii Wagner.= Cæoma mercurialis.
populina. (Jacq.) = Cæoma laricis Hart.
hypericorum. (D.C.)

II. Pucciniastrum. Otth.

M. pustulatum (Pers.)=Ædidium on Abies pectinata.
agrimoniæ. (D. C.) Dietel.
circææ (Schum.)

III. Thecopsora. Magnus.

Melampsora padi. (Kze. and Schm.)
galii (Link)
vacciniorum.(Link.)
pyrolæ. (Gmelin.)

IV. Melampsorella. Schröt.

Melampsora cerastii. (Pers.)

MELAMPSORIDIUM Kleb.

M. betulinum (Pers.)

COLEOSPORIUM. Lév.

I. Eucoleosporium. Winter.

Coleosporium senecionis. (Pers.)= Ædidium pini
tussilaginis. (Pers.)= Ædidium pini
petasitis. De Bary= Ædidium pini

II. Hemicoleosporium. Winter

sonchi-arvensis (Pers.)= Ædidium pini
campanulæ. (Pers.)
euphrasiæ. (Schum.)= Ædidium pini
melampyri (Rebent.)= Ædidium pini

CHRYSOMYXA. Unger.

Hemichrysomyxa. Winter.

Chrysomyxa pyrolæ. (D. C.)
empetri. (Pers.)

CRONARTIUM. Fries.

C. ribicolum. Dietr.= Ædidium on Pinus Strobus.
flaccidum. Alb. and Schw. =Ædidium on Pinus sylvestris.

UREDO.

Uredo chrysanthemi.
symphyti. D. C.
polypodii. Pers.
mulleri. Schröt.
quercus. Brond.
iridis. (Thum.)
phillyreæ. Cooke.
tropæoli. Desm.
lynchii. (B. and Br.)
plantaginis. B. and Br.

MILESIA. B. White.
Milesia scolopendri (Fckl.) B. White.

CAEOMA.
Caeoma saxifragæ. (Strauss.)
euonymi. (Gmelin.) = Melampsora euonymi-caprearum. Kleb.
mercurialis. Pers. = M. rostrupii Wagner.
alliorum. Link.
orchidis. Alb. and Schw. = M. repentis. Plow.
laricis. (Westd.) = Melampsoridium betulinum (Pers.) Kleb.
ari-italici. D. C.
confluens (Pers.)

ÆCIDIUM.
Æcidium aquilegiæ. Pers. = Puccinia agrostidis. Plow.
grossulariæ. (Gmelin.) = Puccinia pringsheimiana (Kleb.)
periclymeni. Schum. = Puccinia festucæ Plow.
Æcidium prunellæ. Winter.
convallariæ. Schum. = P. digraphidis Sopp.
barbareæ. D. C.
clematidis. D. C.
sonchi. Johnst.
ranunculacearum. D.C.
dracontii. Schw.
strobilinum. (Alb. and Schw.)
incarceratum. B. & Br.
phillyreæ. D. C.
galucis. Dozy. & Molk. = Uromyces lineatus Desm.
poterii. Cooke.
punctatum. Pers.
leucospermum. D. C. = Endophyllum.
bunii. D.C. = P. bistortæ
euphorbiæ. Gmelin.
elatinum. Alb. and Schw.
pseudo-columnare. J. Kuhn. ? Puccinia-strum pustulatum.

USTILAGINEÆ. Schröter.

USTILAGO. Pers.
Ustilago longissima. (Sow.)
hypodytes. (Schlecht.)
tritici. Pers.
hordei. Pers.
nuda. Jens.
perennis Rost.
grandis. Fries.
grammica. B. and Br.
marina. Durieu.
hypogæa. Tul.
caricis. (Pers.)
bistortarum. (D. C.)
olivacea. (D. C.)
Ustilago bromivora. (Tul.)
maydis. (D. C.)
vinosa. (Berk.)
scabiosæ. (Sow.)
flosculorum. (D. C.)
utriculosa. (Nees.)
violacea. (Pers.)
vaillantii Tul.
major. Schröt.
kuhneana. Wolff.
tragopogi. (Pers.)
cardui. E. v. Wald.

SCHROETERIA. Winter.
Schroeteria delastrina. Wint.

SPHACELOTHECA. DeBary.
Sphacelotheca hydropiperis. (Schum.)

TILLETIACEI. Schröt.

TILLETIA. Tulasne.
Tilletia tritici. (Bjerk.)
decipiens. (Pers.)
striæformis. (Westd.)
rauwenhofii F. v. W.

UROCYSTIS. Rab.
Urocystis occulta. (Wallr.)
agropyri. (Preuss.)
fischeri. Korn.
colchici. (Schlecht.)
sorosporioides. Korn.
gladioli. (Requien.)
anemones. (Pers.)
violæ. (Sow.)
primulicola. Magnus..
filipendulæ. Fckl.

ENTYLOMA. De. Bary.
Entyloma fergussoni. (B. & Br.)
bicolor. Zopf.
ranunculi. (Bon.)
matricariæ. Trail.
chrysosplenii. (B.&Br.)
microsporum. (Ung.)
calendulæ. (Oud.)

MELANOTAENIUM. De. Bary.
Melanotaenium endogenum. De. Bary.

TUBERCINIA Fries.
Tubercinia trientalis. B. and Br.
scabies. Berk. ?

DOASSANSIA Cornu.
Doassansia alismatis. (Nees.)
sagittariæ. (Fckl.)

THECAPHOREI. Schröt.

THECAPHORA Fingerhuth.
Thecaphora hyalina. Fing.
tralii. Cooke.

SOROSPORIUM. Rudolphi.
Sorosporium saponariæ. Rud.

GRAPHIOLA. Poiteau.
Graphiola phœnicis. (Moug.)

ENTORRHIZA. C. Weber.
Entorrhiza cypericola. Magnus.

TUBERCULINA. Sacc.
Tuberculina persicina. Ditm.

PROTOMYCES. Unger.
Protomyces macrosporus. Unger.
rhizobius. Trail.
pachydermus. Thum
menyanthis De Bary
ari Cooke.

MOLLISIA CINEREA AND ITS VARIETIES.

By Charles Crossland, F.L.S.

While examining Molliseæ of the cinerea group one has often put to oneself the query—What is the real *Mollisia cinerea* = *Peziza cinerea* first described by Batsch Contr. myc. I. p. 196. fig. 137.?

This question has been a puzzle to successive generations of Mycologists and most likely will remain so.

It appears to be difficult to say what the real species was which Batsch had before him, from which he took the following description:

> "Sessile, cinereous, reflexed, margin crisped and sinuate-
> "lobate.
> "Orbicular when young, or oblong and more closed;
> "when full grown more spreading, irregular, when more
> "fully grown irregularly pulvinate, disc obsolete, scrobiculate
> "margin lobate, lobes short and rather broad; margin be-
> "tween the elevated lobes depresso-sinuate, and therefore
> "crisped.
> "Substance horny; semipellucid, cinereous, somewhat
> "moist, dark, but becoming white when it begins to dry,
> "when dry membranaceous, dirty white.
> "The substance, scrobiculate and crisped margin, differs
> "it from *grisea* Elenchi, but possibly it may be a variety
> "of it."

At first sight this appears to be fairly comprehensive for a superficial description of a species so small as a Mollisia.

Unfortunately for it, some species of Mollisiæ exhibit varying phases according to age and conditions of growth: sometimes the hymenium will be plane, with even margin, and the ascophores small ($\frac{1}{2}$ mm.); at other times the development of the hymenium will be so luxuriant as to force itself into all kinds of contortions, with margin fantastically waved or lobed, and the ascophore large (3 mm.) The colour also may vary a little. When growth is most luxuriant the disc is whitest. Further, the ascophores may be scattered and quite free from each other, or densely crowded and much contorted through mutual pressure.

Thus we have data furnished for very variable external descriptions. Microscopic characters are the most constant and reliable, but, at the time Batsch described his species, 1784, external descriptions were mostly relied upon, those of a microscopic nature not being sought into. Batsch does not mention the spores, nor even the asci, in any way.

The species most generally accepted as *M. cinerea* is the one that is very common on dead wood and branches, almost anywhere; it has an undulate, pale cinereous disc, crisped margin, guttulate, narrowly elliptical-oblong spores 6-9 μ long by 2-3 μ thick, glistening paraphyses 3 μ thick, and brown, septate hyphae springing from beneath the ascophore.

Several distinct species of Mollisia, Belonidium, etc., are very similar in external appearance to this one, and would fit Batsch's description quite as well. Some of these have no doubt been passed over by pocketlens examination for the common species accepted as M. cinerea. For instance a comparatively new species, *Echinella setulosa* Mass, and Crossl. found on Calluna vulgaris often bears a striking external resemblance to some forms of the common species, and had several times been passed over before being microscopically examined. The margin was found to be minutely setulose (not readily recognised) and the spores to be 4-5 times the length of those of the common species viz: 38-45 by 2·5-3μ. We found another very similar thing on bark (not yet determined) with the spores 9-14 by 3-4μ, finally 3 septate.

While distinct species have been taken for cinerea, the common form has on the other hand undoubtedly been described under several names on account of its variable appearances.

Saccardo Syl. VIII. n 1393, includes, as synonyms, under Mollisia cinerea (Batsch) Karst. M. F. 1 pag. 189, P. cinerea Batsch. cont. 1,p. 196, f. 137, Sowerb. f. 64, Nees syst. f. 269 P. Callosa Bull. Champ. pag. 252 t. 416, f. 1, Batsch. cont. 1 I. p. 95. f. 219 (icon non obstat) Flor. Dan. f. 1490, f. 2, P. plana, P. alnea et obconica Schum. I. c. pag. 417, 423, P. sub-carneo-pallens A.S. p. 307, P. salicaria Pers. Nipt. cin. Fuck. Sacc. F. it. f. 1376.

The above may or may not be true synonyms, I cannot say, some authors do not think they are.

Saccardo, however, in addition to the above brings under the shade of cinerea no less than 12 other varieties and forms whose spore characters are scarcely consistent with the idea that they can be brought under one species.

The 12 forms or varieties Saccardo includes under M. cinerea. Syl. VIII. n 1393. with dimensions of Asci, and spores, and characters.

	Asci.	Spores.	Habitat.
a luteola -	25-35 × 4-5μ	5-6 × 1-1·5μ	*On decorticated castanea.
b grisella -	40-45 × 4μ	9-10 × 1·5-2μ	*Eupatorium cannabinum.
c culmina -	35-45 × 3·5-4μ	5-6 × 1-1¼μ	*Grass culms.
d caracina Sacc.	55-60 × 5μ	10-12 × 1·5-2μ	*Carex glauca.
e olivescens Sacc.	60 × 5μ	8-10 × 2-2·5μ	Decayed wood.
f macrosperma -	60 × 10-12μ	12-14 × 2-3μ	*Rotten wood.
g albo-nigella -	40-50 × 7μ	9-11 × 1·7-2μ	Atriplex.
h minutella -	36-40 × 5-6μ	7-8 × 1·5-2μ	Spiraea.
i leptospora -	40-50 × 5-6μ	13-14 × 2μ	Epilobium.
j epilobii Kunz -	40-45 × 5μ	6-7 × 2·5μ	Epilobium.
l canella Karst -	50-67 × 6-7μ	8-14 × 2-3·5μ	Alnus and Quercus.
m revineta Karst	40-45 × 4μ	6-8 × 1-1·5μ	Spiraea.

The star'd spores are stated to be 2-guttulate.

The spore dimensions varying from 5-6 by 1-1¼ μ in *culmina* to 8-14 × 2-3·5μ in *canella* Karst. The dimensions of the asci are also extremely variable, ranging from 25-35 by 4-5 μ in *luteola*, to 60 by 10-12 μ in *macrosperma*. We cannot conceive of variation to this extent coming under one species, either as forms or varieties.

Without any desire to increase the number of species by any hair-splitting policy, it may be that several of the 12 forms deserve specific rank. Dr. Rehm in Rabhn. Krypt Flora Albthung III. p. 525, has given this to *minutella*, and placed *epilobii* Kunze under it as a synonym.

We do not think species with 2 guttulate spores should be placed here. If spore characters have to count for anything *leptospora*, 13-14 by 2 μ, and eguttulate, cannot possibly be classed with *culmina* spores 5-6 by 1-1¼μ and 2 guttulate. So with others. Five of the twelve are stated to have 2 guttulate spores. Independent of variability in size, we do not consider any form having guttæ in its spores should come under the common *cinerea*.

In well known species, (not particularly Mollisiæ), that have guttulate spores, the guttæ are constant, and vice-versa so that it is not safe to unite under one species, those having *guttulate*, with those that have eguttulate spores. Characters that can be proved to be constant, and are distinct from those pertaining to other species, must count for something in the summing up, of what we understand as specific differences. Batsch's species was found on wood and Saccardo placed it in his Ligni corticola section all right yet four only of the 12 sub-pended forms, *luteola*, *olivescens*, *macrosperma* and *canella*, are stated to grow on wood, while the remaining 8 are on herbaceous stems.

If species inhabiting herbaceous stems may be included why not *atrata*, *atro-cinerea*, *Lycopodei* spores 8-9 by 1·5-2·5 μ *polygoni* sp. 7-9 by 2 μ *lycopincola*, spr. 7-10 by 2-2·5 μ *coeruleus* spr. 10 μ long etc., etc.

If this method is adopted all these and others might be brought under the convenient wing of the common *cinerea*.

Seeing that this common species is practically spread over the globe we must allow it scope for variation, but we must at the same time, have a limit. If we could place under *cinerea* all *Mollisiæ*, with a cinereous, whitish, or pallid, concave, plane, undulate, or contorted hymenium, margin even or crisped; spores oblong or oblong-fusiform, hyaline, continuous, and eguttulate, with a limit of dimensions to 6-10 μ long by 2-3 μ thick; and paraphyses rather stout and rigid 3 μ thick with shining oily looking contents and no other kind, we should arrive at something definite. Some authors state that the base is furnished with brown hyphæ. These are often seen in the common species, but this factor, in itself is not a distinctive character, as brown hyphæ also occur in other species. Belonidium pullum, for instance.

A thorough revision of the genus is out of the question. An examination of the various exsiccati, even if one had the opportunity, and the perseverance necessary to perform the task, seems hardly likely to produce a satisfactory result. It is impossible to sufficiently revive the dried specimens so as to accurately determine the essential characters.

At the same time it is very desirable to have a more exact classification of this genus: and a more definite limit fixed to the various species; care being taken on the one hand not to confound species which are different, and on the other, not to multiply species by failure to observe the differences of the same species which may be due only to variations of light, moisture, situation, age, etc. This can only be done by careful records of fresh material with thoroughly accurate descriptions and drawings, with special regard to the difficulties which have now become so painfully apparent.

NOTES ON HANTS FUNGI.

By Rev. W. L. W. Eyre, M.A.

The circular of our present Meeting announces a paper, "Notes on Hants Fungi." The remarks I have to make are limited to the larger forms. There are apparently few persons who take much interest in our Fungi—as one of those few, a long residence in the County, and opportunities through moving about my parish to collect and identify the various forms, are the reasons which I would offer as a sort of justification for venturing to address members whose knowledge of the matter is far more wide and intensive. Some of us in connection with the Hampshire Field Club have made attempts to bring the subject of the Fungi into greater notice. We cannot at present be said to have met with much success. Natural history does not seem to be as popular as the antiquities and local history of our towns and villages. A few years ago we organized a day meeting—assembling at the close in the Hartley Institute, Southampton; on two or three occasions since we have met at Lyndhurst. The results of our wanderings were the identification, chiefly by Dr. Cooke or Mr. Massee, of the species found. It is these species gathered on these occasions that I have admitted into the printed list—copies of which I would ask your acceptance lie on the table before me. The list is based primarily on knowledge of the Fungi growing in the northern part of the County. So far as it extends, the list may be relied upon with every confidence, most generous assistance has been rendered by our leading authorities, and nothing questionable has been admitted without a large amount of certainty.

It is important to mention this because the appearances of the Fungi are so erratic; some I have only seen once or twice, and it might be thought, if not found, some error had crept in. Among these varieties are *Cortinarius azureus* and *russus*, *Lepiota Badhami*, *Russula aurata* and *citrina*, but sketches made at the time leave no doubt but that these species have really occurred.

Some species the County has produced for the first time in the British Islands, as *Cortinarius azureus*, *argutus*, *firmus*, *riculatus*, *injucundus*, *subnotatus* and *triformis*, it is quite possible that we may meet with these again in our present researches, but so far, they belong

rather to the upper part of the County than the south. *Clitocybe zygophylla* may be added, with *Schulzeria Eyrei*, the latter very unusual, so few of this genus being as yet known throughout the world—the spores are bluish-green—a figure may be found in the last number issued of "Grevillea;" both of these only occur in the neighbourhood of the Grange Park.

Cortinarius orichalceus is a peculiarity of the New Forest, Dr. Cooke pointed it out on the green near Emery Down, in front of the Swan Inn. *Lactarius cyathula*, under birches, on rising ground east of the Kennels, near Minstead, is another, the only places where these are known to grow. *Boletus duriusculus* is a third, though found sparingly in other places, but in Hampshire only in the Forest.

The partiality of certain Fungi for places such as rotten wood is well known; but I would like to suggest the desirability of the quality of the soil (where possible) have a more prominent place in our descriptive notes. Flowering plants are located pretty definitely owing to the invention of the Watsonian provinces and their subdivisions, but this is geographical. A geological enumeration would add still further information to the objects of our special study. Not much has yet been done in either direction; something of this kind might be of advantage in the future. May I illustrate my meaning, from what I have observed of certain species in my own district compared with the Forest; in the north of the County there is a large portion consisting of bare chalk, another of clay or chalk marl, and some Fungi year after year cling to the one district, irrespective of what goes on in the adjoining part. Particular species seem to keep very close to their own selections.

On the chalk we find *Amanita strobiliformis*, *Entoloma Bloxami*, *Stropharia inuncta*, *Cortinarius dolabratus* and *rigens*, also *Clitocybe nebularis*. *Amanita strobiliformis*, thought very generally to be among the rarer kinds, is with us in the months of August and early in September extremely abundant, so much so that scores may be seen destroyed by the labourer's boot as he returns over the downs at the close of his day's work; indeed, we value this species next to the mushroom as one of the best for culinary purposes, cooked slowly in milk after being cut into pieces it makes no bad imitation of scolloped oysters. On one particular bank we can generally secure *Boletus satanas;* these half-dozen or so we may class as definitely preferring the chalk —*Tricholoma spermaticum*, *Russula vesca*, *Lactarius scrobiculatus* and *controversus*, *Psilocybe semilanceata*, *Clitocybe zygophylla* with *Cantharellus cibarius*—have a distinctive love for the clay or chalk marl. Our clay is not of the tenacious, glue like quality of some districts, but it seems to sufficiently influence the growth of the above species.

As to the New Forest, with more sand in the composition of the soil, we have *Tricholoma sejunctum*, *Lactarius cyathula*, *Clitocybe clavipes*, *Cortinarius orichalceus* and *sanguineus*, *Boletus duriusculus*. None of

these, and there are others, do not occur in the north of Hants, so that the mention of soil as well as form, with other details, should enter into our definitions.

Such a proposal does not seem a difficult one to carry out. County lists where they exist might be examined and the matter tested. If these lists are at present too imperfect, someone, from what is already known, might take the subject and follow it up. Our Annual Meeting would form a good occasion for comparison.

Fungus forays are apt to assemble and disperse, and facts known perhaps to a few escape permanent record. The point I would emphasize is, do Fungi, the larger forms more especially, conform to geological conditions? The amount of moisture and temperature doubtless have a predominant influence in the growth of these plants, but may not the chemistry of the soil have an importance of which at present we know so little in the prevalence of Fungi in certain areas: light soils 1 foot below surface are 1° warmer than air, heavy soils 1 foot below surface 0°2 warmer than annual mean temperature of the air.*

To those who are on the watch, the occurrence of particular Fungi year after year in the same places has been remarked over and over again. They do not appear with the same regularity as the arrival of the flowering plants, they are more casual and uncertain; but the species sooner or later, usually, if not this season then the next, come up in the old places. Being so perishable, passing away many of them in so short a time, makes the matter one demanding pretty close attention. Still, it does seem not at all an *impossible* aim to attempt; probably an additional stone might be added to the accumulating heap of knowledge that has been slowly and patiently gathered during the last few years of the century, of a curious and interesting study.

Our list of Hants' Fungi, as here printed, reaches 580 species, about 30 found in the Forest have not yet been found *except in the South*. The district most closely examined is the Grange Park as a centre, lying between Alresford and Micheldever.

* See J. of Royal Meteorological Society, Vol. xxv. p. 252.

FUNGI NEW TO BRITAIN.

By Annie Lorrain Smith.

Apodachlya Pringsh.

Hyphae with cellulin grains, constricted at intervals, branched, the branches rising immediately below the constriction; sporangia terminal, pyriform or globose, few-spored; zoospores on escaping become surrounded by a thin pellicle and remain for a time at the mouth of the sporangium, swarming later with two lateral cilia and leaving a hollow sphere of empty cells; sexual organs unknown; conidia terminal, globose.

A. pyrifera Zopf.

Mycelium long; sporangia pyriform, sometimes ovate or fusiform with a small beak, a fertile branch often rising beneath the emptied sporangium, the repeated branching forming a sympodium; spores bean-shaped; conidia globose, with a smooth cuticularized outer wall. Found by Dr. Maurice Gepp on a hazel stick floating in running water near Shrewsbury. Journal of Botany. May 1899. Communicated by Mr. A. Gepp.

Achlya racemosa Hildeb.

Hyphæ large up to 80 μ thick; sporangia cylindrical-clavate, large, varying in size from 166-640 μ in length by 64-21 μ in width; oogonia terminal on short stout branches, produced in great numbers along the main hyphae, globose, 50-57 μ in diameter with a thick brownish or yellowish membrane with few oospheres; antheridia always present one or two to each oogonium, obconical, on slender branches which rise from the stalk of the oogonium; oospores few 1-6, rarely up to 12, globose, thick walled, smooth, 20-30 μ in diameter.

Var. *stelligera* Cornu, similar to the above but the oogonium beset with wart-like outgrowths.

Found on a hazel stick floating in running water near Shrewsbury. Journal of Botany. May 1899.

Dictyostelium Bref.

Forming mucor-like heads of spores on a long stalk, white or reddish; stalk simple or sparingly branched,cellular; spores

producing on germination an amoeboid body, these bodies flow together and gradually creeping upwards they build up the stalk and the head of naked spores.

The genus Dictyostelium forms part of a small group of organisms the *Acrasieæ*. They were included among the *Mycetozoa* by De Bary but have been separated off from those by recent writers, on the ground that they do not form a true plasmodium.

D. mucoroides Bref.

Whole plant greyish white; stalk gradually tapering upwards; head of spores round, varying very much in size, dispersing when touched; spores elliptical, variable in size, usually about 5 by $2\frac{1}{2}$ μ, colourless.

My attention was first called to this plant by Mr. F. Jenkin who found it growing on an old cardboard box at Newport some years ago. I have again found it growing on some rabbit dung that I gathered at Llanwymawddwy, N. Wales, in Aug. 1899. The material was put away in a perfectly dry condition for some months, then when moistened and kept damp, this and other fungi grew abundantly. I cannot find any record of *Dictyostelium* for this country. Mr. Jenkin first detected it in January 1897. It can only be seen under the microscope and in a growing condition.

Didymocladium Sacc. Syll. Fung. IV. p. 186.

Fertile hyphæ erect, veticillately branched; conidia borne at the tips of the branches, elliptical, 1-septate, catenulate, colourless.

D. ternatum Sacc. *Cladotrichum ternatum* Bon. Handb. p. 78 fig. 86. Forming white woolly tufts, branches short usually in verticils of three, tapering to the tips which are inflated more or less with conidia in formation; conidia elliptical in rather long chains with a tendency to drop apart. The size of spores is not given; in the specimen under examination they measure 12-15 μ by 5μ, as the other characters agree with the above description I have no hesitation in assigning it here. Found by Rev. W. L. W. Eyre on old *Stereum* at Alresford, Hants. Dec. 1899.

Trichosporium splenicum Sacc. and Berl. Miscell. Myc. II. No. 137. t. IX. f. 14 (In Venezia Istit. Atti. ser. 6 Vol. III. pt. 1. p. 141. 1885).

Effused, velvety, blackish-brown; hyphæ erect, continuous, olive-brown, branched, 120 by 3 μ, the branchlets asperulate at the tips; spores obovate-reniform 4-5 by 2-3 μ often 1-guttulate. olive-brown.

Forming velvety patches on bark of decaying wood. Llanwymawddwy, N. Wales. Coll. Aug. 1899.

Coniothyrium Kerriae Le Bret. in Rev. Myc. Oct. 1891. p. 169.

Pustules scattered, numerous, pulvinate, developed under the bark about $\frac{1}{2}$ mm. in diameter; spores globose brown 4-6 by 4-5 μ

On dead branches of *Kerria Japonica*, Seamill, West Kilbride, Ayrshire. Nov. 1897. Mr. D. A. Boyd.

Protomyces Bellidis Krieger.

Forming small yellow spots on the leaves, scattered or crowded, with little or no swelling of the tissue; resting spores faintly yellow, globose or somewhat longer than broad 30-45 μ in diameter, smooth, the epispore 1.5-3 μ broad.

Growing on leaves of Bellis perennis at Seamill, West Kilbride, Ayrshire. Autumn 1899, and also in previous years. Mr. D. A. Boyd.

Thelebolus Tode. Fung. Meckl. Sec. I. p. 41.

Forming a closed fruit consisting of an outer layer (stroma) which contains usually one ascus surrounded by an inner investing layer (perithecium), or several asci each with its own investment enclosed in the outer common layer; asci many-spored; spores elliptical, one celled, colourless, gathering into a ball at the apex of the ascus before expulsion; paraphyses very delicate, evanescent.

T. nanus Heim Æsterr Ascob. p. 30 f. ii.

Very minute, globose or somewhat flattened up to 130 μ in width, colourless; asci one or more, somewhat elliptical, varying in size and form swelling after escape from the perithecium, from 50-100 by 30-55 μ up to 140 by 80 μ; spores 5-6 by 3 μ; paraphyses slender, septate.

The inner investing layer of the ascus is very delicate and easily overlooked, so that when several are present the plant presents the appearance of a single perithecium containing several asci. On rabbit dung, Llanwymawddwy, N. Wales.

The same plant has been collected for two years in succession by Dr. Plowright on rabbit and cow's dung at King's Lynn. Zukals microscopic measurements for *Thelebolus stercoreus* (Denkschriften der K. K. Akademie der Wissenschaften, Band 51, 2nd Abtheilung p. 22) have been adopted by succeeding writers, Saccardo, Schroter and Rehm, though Schröter (Kryptogamen-Flora von Schlesien, Band III., 2 Hälfte, Lief I. p. 51.) queries the identity of the two plants, Zukals being about 1-10th of a mm in diameter, while Tode's is described and figured as the size of a "poppy seed." The plant I have been dealing with is smaller than Schröters; I have followed Heimerl's nomenclature, placing it under *T. nanus* though I am strongly inclined to think it is only a smaller form of Zukal's plant, the only difference

between the two species is the size of the mature plant and of the asci, the spores in both species are almost alike. I have never been able to see the paraphyses.

Barlaea modesta Sacc. Karsten, Mon. Pez. Fenn, p. 122.
Among Hepatics on sandy soil, bank of stream, Wade wood, Luddenden Dean, near Halifax. T. W. Woodhead, Oct 1898. Naturalist Jan. 1899. p. 27.

Humaria rubens Boud. Bull. Soc. Myc. 1896. p. 13.
Among moss on wall top, Nut Clough, Hebden Bridge, Oct. 1899. Collected by Mr. James Needham. Naturalist Jan. 1899. p. 27.

H. deerata Sacc. Karst. Mon. p. 119.
On decaying flax-lining of a cast-out hearthrug, Pecket Wood, near Hebden Bridge. June 1897. J. Needham. Naturalist, Jan. 1899. p. 28.

Mollisia pteridina Karst. Myc. Fenn. I. p. 194.
On decaying fern stems, High Greenwood, Heptonstall, May 1897, Naturalist Jan. 1899, p. 28.

Ascobolus Leveillei Boud, Mem sur les Ascoboles p. 35.
In immense numbers on horse dung, Copley, near Halifax Nov. 1898. Naturalist Jan 1899. p. 29.

A. Crosslandi Boud. Bull Soc. Myc. tome XIV. pp. 126-127.
Salterhebble, near Halifax. Oct. and Nov. 1897. Naturalist Jan. 1899, p. 29.

Saccobolus granulospermus Sopp. and Crossl.
On ox dung, Harewood, near Leeds. Sept 1898. Yorkshire Naturalists' Union Fungus Foray. Naturalist Jan. 1899. p. 30.

E.A.Rea del.

West, Newman lith.

Lactarius theiogalus. *Fr.*

LACTARIUS THEIOGALUS Fr.

One of the common Lactarii which is frequently overlooked in this county is *L. theiogalus* Fr., a firwood species, of a reddish brown colour; it is passed over for *L. subdulcis*, *serifluus* or *quietus*, a trio which those who have studied fungi the longest are the most chary about discriminating. In the sulphur coloured milk, however, we have a character that at once sufficiently separates the plant under discussion, provided time be given to allow the change of colour to take place. Growing gregariously in late autumn, often amongst short heather, the colour of the pileus, when once recognised, is distinctive. It has, when moist, a peculiar liver coloured tint with a decided brownish shade. The gills are rather distant and the margin of the pileus indented or scolloped where each gill ends; this is best seen from beneath. There is no figure in Cooke's Illustrations: and of those quoted by Fries none are distinctive. Bolton t. 9 is far too bright red. Bulliard t. 567, f. 2, is better, and certainly has yellow milk, but the infundibuliform pileus is distinctly zoned, and a change of colour to yellow is shown in the flesh of section which does not correspond with nature. Krombholz t. i., f. 23 and 24, does not look like the plant at all, while Paulet t. 71 may be anything. Larber t. 17, f. 1, is probably the plant, but Fries does not quote this figure.

Lactarius chrysorheus is not a firwood species, and is known at once by its whitish colour and by the milk changing immediately to golden yellow; whereas in *L. theiogalus* the white milk does not become yellow until after the lapse of a considerable interval, perhaps twenty minutes or half an hour, and even then the colour is never so deep a yellow.

The figures are from drawings by Mrs. Carleton Rea, from specimens found at Ashwicken, Norfolk, 1st November, 1899.

Pileus 2½-7 cm. across, liver coloured when moist, drying to rufous tawny and lighter at the margin, convex when young, then expanded and finally depressed, umbonate, but umbo sometimes wanting, smooth, zoneless, viscous at first; margin crenulate and thin; flesh of the pileus palid, then ochraceous, thick at the centre but thinning out towards the margin. Stem 3-4 cm. long, ½-1 cm. thick, stuffed, then hollow, equal, attenuated at the base, smooth, slightly pinker than the colour of the pileus, flesh becoming rufous especially downwards. Gills adnato-decurrent, each terminating at the crenulations of the margin of the pileus, 3-6 mm. broad, thin, rather distant, pale then rufescent. Milk white, then very slowly changing to sulphur yellow, mild, then slightly acrid. Spores 6-7 μ, globose echinulate.

The following Members have joined the British Mycological Society.

Acland, Sir Charles Thomas Dyke, Holnicote, Taunton, Somerset.

Biffen, Mr. R. H., Botanical Laboratory, Cambridge.

Blackman, Mr. V. H., British Museum (Natural History), Cromwell Road, London. S.W.

Crawford, Mr. W. C., 1, Lockharton Gardens, Edinburgh.

Jenkin, Mr. Charles Frewen, 4, Vanbrugh Park Road, West Blackheath.

Mott, Mr. Frederick Thompson, Crescent House, Leicester.

Paul, Rev. David, LL.D., 53, Fountainhall Street, Edinburgh.

Smith, Mr. Worthington G., 121, High Street, Dunstable.

Tatum, Mr. E. J., Salisbury.

Watson, Dr., Deputy Surgeon-General, University Club, Edinburgh.

OFFICERS FOR THE SEASON 1898-1899.

President: Charles B. Plowright, M.D., King's Lynn.

Hon. Secretary and Treasurer: Carleton Rea, B.C.L., M.A., 34, Foregate Street, Worcester.

THE ROTHIEMURCHUS FOREST FORAY.

17th to 22nd Sept., 1900.

The fourth annual week's Fungus Foray of the British Mycological Society was held at the Boat of Garten from the 17th to the 22nd of September, 1900, and by a happy coincidence the Cryptogamic Society of Scotland had also arranged their annual Foray there. The members of the two Societies assembled at the Hotel Boat of Garten on Monday, the 17th of September, where they found many interesting specimens collected by Dr. C. B. Plowright awaiting their inspection, displayed on tables in the Public Hall, which adjoined the hotel. The Hon. Sec. also put out on exhibition a specimen of *Strobilomyces strobilaceus* Berk., gathered that day by him in the policies of Murthly Castle, and which he understood was of uncommon occurrence in Scotland.

On Tuesday, the 18th of September, the early train was taken to Aviemore; from whence the members proceeded, under the leadership of the Rev. Dr. Keith (President of the Cryptogamic Society of Scotland), to the Dell of Rothiemurchus Forest. Here many interesting species were noted, including *Armillaria robusta* A. & S., *Tricholoma equestre* Linn., *T. portentosum* Fr., *T. pessundatum* Fr., *T. virgatum* Fr., *Cortinarius (Inoloma) traganus* Fr. and *tophaceus* Fr., *Cortinarius (Dermocybe) orellanus* Fr., *Paxillus atrotomentosus* Fr., *Hygrophorus agathosmus* Fr., *Lactarius scrobiculatus* Fr., *Hydnum imbricatum* Linn., *H. fragile* Fr., *H. scrobiculatum* Fr., and *H. compactum* Pers. The walk was then continued to the Rev. McDougal's house, the members gathering on the way specimens of the destructive parasite *Trametes pini* Fr.

On Wednesday, the 19th of September, the Rev. Dr. Keith conducted the members into the adjacent Forest of Abernethy and round to Loch Garten, which is beautifully wooded and stands out in pleasing contrast to the neighbouring mountains. Many examples of *Sistotrema confluens* Pers. were found, and a large patch of *Cordyceps ophioglossoides* Fr. parasitic on *Elaphomyces variegatus* Vitt. was discovered by Professor Marshall Ward, whilst Dr. Plowright secured *Entoloma erophilum* Fr. (new to the British Fungus Flora), *Stropharia scobinacea* Fr., *Flammula scamba* Fr., *Hydnum ferrugineum* Fr., *Stereum Sowerbeii* B. & Br., between the bark of a pine stump, and *Humaria*

violacea Sacc. was found on burnt heaps by the Rev. Dr. Stevenson. In the evening Professor H. Marshall Ward, Dr. Sc., F.R.S., &c., delivered his Presidential Address, entitled "The Nutrition of Fungi" (see page 124), which was much appreciated by the Members of the two Societies.

On Thursday, the 20th of September, the Forest of Rothiemurchus was again visited, our esteemed conductor, the Rev. Dr. Keith, leading the way to Columbridge and thence to Loch-an-Eilan. Many interesting species were gathered on the way, including *Entoloma Bloxami* Berk., *Pholiota flammans* Fr., *Hygrophorus turundus* Fr., *Cortinarius (Inoloma) pholideus* Fr., *Lactarius hysginus* Fr., *Pleurotus mitis* Pers., *Naematelia encephala* Fr., and *Cudonia circinans* Fr. At 6.15 p.m. the business meeting of the British Mycological Society was held. Professor H. Marshall Ward, Dr. Sc., F.R.S., F.L.S., &c., was unanimously re-elected President for the ensuing year, and Mr. Carleton Rea, B.C.L., M.A., Hon. Sec. and Treasurer. Mrs. Montague's invitation to search 4,000 acres of woods near Crediton, with Exeter as head-quarters, was unanimously accepted, and the date fixed for the last week in September, 1901.* Professor Marshall Ward kindly contributed to the Society a valuable paper of original research on "Naematelia" (see page 143). A hearty vote of thanks was accorded to Mrs. Carleton Rea for kindly colouring the 200 plates in the last number. The Hon. Treasurer pointed out that the costs of the Transactions were rather beyond their means, and if the same were to be maintained in a high rate of efficiency more funds were necessary. He suggested that the number of foundation members should be closed at 71 and not limited to 100 as per rules. On the proposition of Dr. C. B. Plowright, seconded by the Rev. Dr. D. Paul, it was unanimously decided that an appeal should be made to the members to contribute voluntarily an annual sum in addition to their subscription until the funds of the Society were sufficient to enable them to publish their Transactions with plates, which were necessarily costly, out of the annual income, and the Hon. Sec. was directed to send a circular embodying this resolution to all the members. In the evening Mrs. Carleton Rea exhibited drawings of Collybia veluticeps Rea and Mycena carneosanguinea Rea, which are shortly described in full at page 157.

On Friday, the 21st September, the members proceeded to the woods to the west of the Boat of Garten, but beyond a *Boletus* thought to belong to the *Gyrodon* group little of any consequence was found, and hence the members in the afternoon again resorted to Abernethy Forest, where fine examples of *Lactarius hysginus* Fr., *Tubaria paludosa* Fr., and *Omphalia umbratilis* Fr. were found.

Saturday, the 22nd September. Many of the members dispersed on this day, but a few ardent members remained to take the 12.15 train to Aviemore, from whence through birch-clad hills they walked to Lynwilg and on to a pine wood some mile to the southward and

* Monday, 23rd September—Saturday, 28th September.

on the right of the road to Kingussie. This wood was found to be the veritable home of the larger Hydnei, and the bag soon included *Hydnum imbricatum* Linn. in great quantities, *H. fragile* Fr., *H. compactum* Pers., *H. aurantiacum* A. & S., *H. zonatum* Batsch., *H. nigrum* Fr., and *H. melaleucum* Fr. Over 231 species were observed during the week's foray, and many of them were of rare occurrence to the southern members.

Dr. C. B. Plowright remained on a visit to the Forest of Rothiemurchus, and has since reported *Flammula carbonaria* Fr., *Amanita porphyria* A. & S., *Cortinarius (Inoloma) alboviolaceus* Fr., *Cortinarius (Inoloma) cyanites* Fr., *Cortinarius (Inoloma) violaceus*, and *Rhizina inflata* Quélet.

List of Fungi gathered during the Foray.

Amanita phalloides Fr., mappa Fr., porphyria Fr., muscaria Fr., rubescens Fr., spissa Fr.

Amanitopsis vaginata Roze.

Lepiota cinnabarina A. & S., carcharias Pers., amianthina Scop.

Armillaria focalis Fr., near Loch Garten, 23rd September, 1900, robusta A. & S., mellea Vahl.

Tricholoma equestre Linn., portentosum Fr., resplendens Fr., flavobrunneum Fr., albobrunneum Pers., pessundatum Fr., rutilans Schaeff., columbetta Fr., vaccinum Fr., imbricatum Fr., terreum Schaeff., saponaceum Fr., virgatum Fr., sulphureum Fr., melaleucum Pers.

Clitocybe nebularis Batsch., clavipes Pers., odora Sow., fumosa Pers., metachroa Fr., fragrans Sow.

Laccaria laccata Scop., var. amethystina Bolt.

Collybia maculata A. & S., butyracea Bull., velutipes Fr., tuberosa Bull., rancida Fr.

Mycena atromarginata Fr. (Mr. Rea from Altyre Woods), rosella Fr., pura Pers., ammoniaca Fr., alcalina Fr., epipterygia Scop.

Omphalia umbellifera Linn., umbratilis Fr.

Pleurotus ostreatus Jacq., mitis Pers., acerosus Fr., porrigens Pers.

Pluteus cervinus Schaeff.

Entoloma erophilum Fr. (new to the British Fungus Flora), Bloxami B. & Br., jubatum Fr.

Clitopilus prunulus Scop.

Leptonia lampropoda Fr.

Nolanea pascua Pers.

Pholiota ombrophila Fr. (Mr. W. Stewart, Drumnadrochit, 24th Sept., 1900), flammans Fr., mutabilis Schaeff., marginata Batsch.

Inocybe hirsuta Lasch. (Mr. Rea, Birnam and Murthly Castle), maritima Fr., fastigiata Schaeff. (Mr. Rea, Birnam), geophylla Fr.

Hebeloma glutinosum Lindgr.
Flammula carbonaria Fr. (Dr. Plowright, Rothiemurchus), inopoda Fr., sapinea Fr., scamba Fr.
Galera tenera Schaeff.
Tubaria paludosa Fr.
Agaricus campestris Linn. var. silvicola Vitt., haemorrhoidarius Schulz.
Stropharia aeruginosa Curt., albocyanea Desm., scobinacea Fr.
Hypholoma capnoides Fr., hypoxanthus Plow.
Psilocybe semilanceata Fr.
Anellaria separata Karst.
Panaeolus campanulatus Linn.
Coprinus comatus Fr.
Bolbitius fragilis Fr.
Cortinarius (Phlegmacium) claricolor Fr., varius Fr., cyanopus Fr., variicolor Fr., largus Fr., multiformis Fr., napus Fr., purpurascens Fr.
" (Myxacium) collinitus Fr., elatior Fr., pluvius Fr.
" (Inoloma) argentatus Krombh., violaceus Linn. (Dr. Plowright). alboviolaceus Fr. (Dr. Plowright), traganus Fr., tophaceus Fr., pholideus Fr.
" (Dermocybe) anomalus Fr., cinnamomeus Fr., var. semisanguineus Fr., orellanus Fr.
" (Telamonia) torvus Fr., armillatus Fr., gentilis Fr.
" (Hygrocybe) obtusus Fr., acutus Fr.
Gomphidius glutinosus Schaeff., viscidus Fr., roseus Fr., gracilis Berk.
Paxillus involutus Fr., atrotomentosus Fr.
Hygrophorus hypothejus Fr.. agathosmus Fr., pratensis Fr., var. pallidus B. & Br., virgineus Wulf., fornicatus Fr., laetus Fr., coccineus Schaeff., miniatus Fr., turundus Fr., puniceus Fr., conicus Fr., chlorophanus Fr., psittacinus Schaeff.
Lactarius scrobiculatus Scop., torminosus Schaeff., turpis Fr., blennius Fr., hysginus Fr., vellereus Fr., deliciosus Fr., theiogalus Fr., vietus Fr., rufus Scop., glyciosmus Fr., mitissimus Fr.
Russula nigricans Fr., olivascens Fr., furcata Fr., drimeia Cke. (expallens Gillet), rubra Fr., vesca Fr., foetens Fr., fragilis Fr., puellaris Fr., alutacea Fr.
Cantharellus cibarius Fr., aurantiacus Fr., umbonatus Fr. (Murthly Castle), infundibuliformis Fr.
Marasmius oreades Fr., erythropus Fr.
Lentinus lepideus Fr., cochleatus Fr.
Boletus luteus Linn., elegans Schum., flavus With., bovinus Fr., piperatus Bull., variegatus Sw. chrysenteron Fr., subtomentosus Linn., radicans Pers., edulis Bull., luridus Schaeff., versipellis Fr., scaber Fr.
(Gyrodon)? sp.

Stobilomyces strobilaceus Fr. (Mr. Rea, Murthly Castle).
Polyporus Schweinizii Fr., perennis Fr., fragilis Fr., destructor Fr., amorphus Fr., betulinus Fr., annosus Fr., versicolor Fr., abietinus Fr.
Trametes pini Fr.
Merulius pallens Berk.
Hydnum imbricatum Linn., fragile Fr., repandum Linn., compactum Pers., aurantiacum A. & S., ferrugineum Fr., scrobiculatum Fr., zonatum Batsch., nigrum Fr., melaleucum Fr., auriscalpium Linn.
Sistotrema confluens Pers.
*Thelephora Sowerbeii B. & Br.=Stereum Sowerbeii Massee., laciniata Pers.
Exobasidium vaccinii Woronin.
Stereum purpureum Pers., hirsutum Fr., rugosum Fr., sanguinolentum Fr.
Corticium sanguineum Fr.
Sparassis crispa Fr. (Mr. Stewart, Drumnadrochit).
Clavaria amethystina Bull., cinerea Bull., cristata Pers., abietina Pers., flaccida Fr., stricta Pers., inaequalis Fl., Dan.
Calocera viscosa Fr.
Naematelia encephala Fr.
Rhizopogon luteolus Pers.
Lycoperdon gemmatum Batsch., pyriforme Schaeff., perlatum Pers., caelatum Bull., nigrescens Vitt.
Cudonia circinans Fr.
Helvella lacunosa Afzel., elastica Bull.
Spathularia clavata Sacc.=flavida Pers.
Humaria violacea Sacc.
Rhizina inflata Quélet.
Cordiceps ophioglossoides Fr. on Elaphomyces variegatus Vitt.
Spumaria alba D.C.

* Dr. Plowright does not assent to this determination.

THE NUTRITION OF FUNGI.

BY H. MARSHALL WARD, Sc.D., F.R.S., F.L.S. F.R.H.S.;
Fellow of Sidney Sussex College, Honorary Fellow of Christ's College, and Professor of Botany in the University of Cambridge.
Honorary Fellow of the Manchester Literary and Philosophical Society and of the Botanical Society of Edinburgh.

PRESIDENTIAL ADDRESS.

Ladies and Gentlemen,

We are told that there are at least 40,000 to 50,000 species of Fungi, some say more. As to the accuracy of the census I cannot decide, but the ponderous fact obtrudes that some people have taken charge of this vast family, and undertake to recognise and name many of them and to have a nodding acquaintance with the rest. True, the recognition and naming are frequently done with the aid of photographs, drawings and measurements, etc., as is done in the case of higher organisms with the aid of portraits, anthropometric devices, Galton's finger-prints, etc., but the astounding fact remains that some of my friends can identify hundreds, if not thousands, of these Fungi at sight, and if they do hesitate occasionally as to whether a given species of *Lactarius* is *L. theiogalus* (Fr.) or *L. subdulcis*, *L. serifluus* or *L. quietus*, or whether a doubtful *Mollisia* is the true *M. cinerea* (Batsch) or one of the numerous forms that may have been mistaken for it, they adopt the honest and sensible plan of submitting the question for discussion and reference to the *Transactions of the British Mycological Society* and other works of authority and repute.

Personally, I must confess to a profound admiration of the powers of close and astute observation, and retentive memories for details of these friends of mine, as well as to an utter inability to emulate their confidence in the field, and were it not that I have frequently had occasion to test these powers in most enjoyable rambles in pursuit of Fungi in their natural haunts, should have been much more sceptical of its being possible to attain such confidence.

With these convictions, you will scarcely wonder if I hesitated to incur the responsibility of addressing you in my present capacity, and deeply sensible as I am of the honour of being your president, it is

only on the grounds that we are all interested in all that concerns Fungi that I accepted, knowing that while those aspects of Mycology which most concern me at present must be of interest to you, you will be able to teach me far more than I can pretend to offer in return.

A fungus spore contains but a minute fraction of the food-materials required by the mycelium which developes from it under suitable conditions, and we know that additional supplies must be provided from outside. Moreover, we can trace the destruction and disappearance of the constituents of the food supplied as the mycelium grows, and analyses show that it is especially organic carbon compounds which are accumulated in the growing fungus.

Experiments prove that in no case does this nutrition consist in a mere transference of substances absorbed from the food medium into the body of the fungus : on the contrary, profound and complex changes must occur before the substance of the food becomes substance of the fungus, and these changes are often accompanied by great waste of materials.

The kinds of changes most in evidence are as follows. The food-substances must be rendered soluble and in a fit condition to be absorbed in solution, and this frequently entails alterations brought about by the fungus itself or by some body excreted by it—*e.g.*, the inversion of non-assimilable sugars (Yeast), the saccharification of starch (*Aspergillus*), the softening of horn (*Onygena*) or wood (*Stereum*), and so forth.

Then we find that when the food-stuffs have been absorbed, still more profound chemical decompositions are undergone inside the cells of the fungus. The atoms and molecules are re-arranged and re-distributed in various ways, and never wholly as they were at first. Some of them are temporarily built up into the living structures, only to undergo still more turbulent and disturbing redistributions; some combine with oxygen and are burnt off in respiration; some are finally brought into a condition of comparative rest in the so-called permanent structures of the fungus—*e.g.*, the cell-walls—while others are left to wander here and there, inside or outside the arena of stormy life-activity, and ultimately attain a condition of rest—again only comparative—it may be in union with other vagrant molecules, in the form of some substance not wanted by the plant.

Meanwhile, substances resulting from the various chemical changes referred to, pass out of the fungus into the external world, and may in their turn produce secondary series of alterations on the food medium—may even poison it, in fact—and the now altered food may re-act again on the fungus.

It is in the province of physiology to describe and explain these various phenomena of absorption, conversion, constructive and destructive metabolism and excretion; to show how they are linked together in life-actions, and to discover how the living substance of the fungus is built up and broken down, and how it is enabled to perform those remarkable evolutions we term life.

Now, while we may as well frankly admit that there is not the slightest expectation as yet of any immediate realisation of the latter object—and the intensity of expectation on the part of more sanguine individuals need no more deter us from this admission than the apathy or scepticism of others need exclude the hope that it will one day be attained—it is, on the other hand, clear that great and important advances in our knowledge of the possibilities and meaning of life-actions have been made during the last quarter of a century, and particularly from the study of the Fungi. Certain questions arising herefrom seem to me worth examining by a combination of field and laboratory mycologists.

Analyses have shown that in addition to traces of numerous elements shown to be un-essential to its life, a fungus, freshly gathered, contains about 85-90 °/o of water, and 10-15 °/o of solids. It was then found that in all cases the solid material consists of a combustible portion—about 10-12 °/o of the fresh fungus—yielding Carbon, Oxygen, Hydrogen and Nitrogen, chiefly in the form of Carbon-dioxide, Water and Ammonia, when burnt, and a residual ash —about 1-2 °/o of the whole—containing potassium, phosphorus, magnesium and sulphur, together with traces of calcium, sodium and other minerals.

As experience progressed it was found possible to add that in the intact fungus the elements referred to are combined into Carbohydrates, proteids, fats and traces of other bodies, the minerals being in some way distributed among these so-called organic compounds, but how it was impossible to say.

It was then found that a certain elasticity is observable in the proportions of these elements, and that, while it is generally true that the combustible part contains 50 °/o Carbon, 30 °/o Oxygen, 15 °/o Nitrogen and 5 °/o Hydrogen, for instance, even one and the same fungus contains different proportions of these and of water and of ash at different stages, in different situations, and in its various parts. Thus the proportions in that well studied fungus, *Saccharomyces*, contains, per cent. of dry weight—

Carbon	...	...	...	47	to	50·8
Hydrogen		...	...	6·5	to	7·3
Nitrogen	...	...	...	9·2	to	15
Oxygen	...	...	...	31·4	to	37·1
Minerals	...	...	...	2·5	to	9

And a recent analysis of *Penicillium* gives, in the mycelium, 12·36 °/o of dry solids, of which 11·34 °/o is ash; whereas the spores yield 61·13 °/o of solids, of which only 3·09 °/o is ash.

Again, *Agaricus melleus*. 16·26 °/o of its dry weight are proteids in the fully grown specimens, but in the young state the pileus yields 28·6 °/o and the stipes 26·91 °/o, and similarly with other Fungi.

Another remarkable point is the large proportions of potash and phosphoric acid in the ash of Fungi, these valuable elements often

amounting to 80 or 90 °/o of the total ash. A recent analysis of *Aspergillus* spores, for instance, gave 45·96 °/o of potash and 39·64 °/o phosphoric acid. This is noteworthy, because it is just these minerals which are apt to be rare in soils, or at least only accumulated with great difficulty by plants.

It soon became evident, however, that these destructive analyses of Fungi would never enable the physiologist to understand how the various chemical substances exist in the plant, and that we might as well expect to understand the construction and working of a watch by smashing it up in a mortar and dissolving it in acids, as hope to apprehend the structure and functions of the fungus by these drastic measures; and although numberless delicate investigations continued to show that very curious and interesting chemical compounds can be obtained from Fungi—*e.g.*, the poisonous alcaloids, Muscarin from *Amanita muscaria*, Ergotin from *Claviceps purpurea*, and the long series of brilliant colouring matters and organic acids, and of carbo-hydrates, resins, etc. from Lichens and various Fungi—little progress was being made towards a solution of the principal problems.

It was clear that every fungus contains the elements mentioned; but it was by no means proved that all are necessary. Obviously the only way to decide the matter was to cultivate the fungus and offer it these elements in various proportions, and see whether and how it can build up its substance in each case.

Now there are hundreds of ways of presenting such elements to a growing fungus. It is very easy to make up doses of substances such as calcium carbonate, potassium sulphide, magnesium phosphate, sodium nitrate, etc., in water, but although such a mixture would contain all the elements required, it was soon found that no fungus would grow in it, and that the form in which the elements are combined is an essential point in the food of Fungi. Many trials led to the conclusion that the carbon especially must be presented in particular forms, as otherwise the fungus cannot avail itself of the supply, and this was soon explained when the consequences of the lack of chlorophyll were understood. But it was also found that the nitrogen constituents must also be presented in special forms, or the fungus could not flourish: for instance it is as a rule useless to offer nitrates. And as experience accumulated similar facts came out in other connections.

An excellent food-mixture for many Fungi was then shown to be such as the following.

Ordinary cane-sugar, as the principal source of the carbon; ammonium tartrate, supplying nitrogen, and the ashes of yeast, containing the necessary mineral elements; the oxygen and hydrogen needed being also afforded by the organic materials and water. Many other similar mixtures were also used successfully. But several curious and instructive discoveries soon resulted from culture experiments in such media.

It was found that the cane-sugar is first altered by the fungus and broken up into two other sugars—fructose (levulose) and glucose

(dextrose)—of quite different kinds before being absorbed. It transpired, for instance that the fungus *Saccharomyces* cannot absorb and digest cane-sugar itself until it has been thus broken up. This then was the first point, that the fungus has to so alter this particular sugar into two others easily assimilable by it before it can begin feeding, and it is now known that it does this splitting—hydrolysis—by means of an enzyme which it excretes into the medium.

The next point was that the carbon, hydrogen, oxygen and nitrogen and the mineral matters did not appear in the new fungus, built up by assimilation and growth, in anything like the same forms or proportions in which they were presented. For instance, no ammonia or tartaric acid or sugars were to be found in the fungus, or even in the unemployed food-medium at the end of the experiment. It took a long time to show what changes had occurred, and, put shortly, they were as follows. Certain quantities of the carbon, hydrogen and oxygen, and most of the nitrogen had been built up into the protoplasm of the cell; some of the carbon, hydrogen and oxygen had been converted into the substance of the cell-walls, while a little had gone to form fats; and traces of the mineral matters K., P., S. and Mg., had been retained in some way in the structure of the cells. But far larger proportions of the carbon, hydrogen and oxygen had not been used by the fungus at all—they had been converted into alcohol and carbon-dioxide, with traces of organic acids and glycerine in the liquid outside the fungus, and appear never to have gone into the fungus at all. The second and third points eventually established then were, that while none of the chemicals employed as food had been annihilated or lost, all had been altered; a certain proportion had gone to form new fungus-substance, but far more had been broken up and changed in the external medium. And this, of course, altered the medium itself as a source of food supply. The last of the four points here concerned was not thoroughly demonstrated until some time after. It is that although the sugars named are such excellent media for supplying the most of the carbon, hydrogen and oxygen required by the *Saccharomyces* known as Beer-yeast, and there are one or two other kinds of sugar it can also digest and assimilate; it starves if we attempt to feed it on other sugars. For instance, milk sugar (Lactose), though it contains carbon, hydrogen and oxygen in the same proportions as does cane-sugar,* is sweet and an excellent food, yet our yeast-fungus will starve if this is its only source of carbon. Now what explanation can we give of this ?

It is not because Lactose is useless to all Fungi; because another species of yeast (*Saccharomyces acidi-lactici* is known which flourishes perfectly well in it. A clue is obtained when we recall the fact that our fungus cannot directly assimilate cane-sugar, and add that certain other simple Fungi—*e.g.*, *Monilia candida*—can do so. One reason

* Strictly speaking

Cane sugar $= C_{12} H_{22} O_{11}$

Lactose $= C_{12} H_{22} O_{11} + H_2 O$

our *Saccharomyces cerevisiae* cannot utilise milk sugar as its source of carbon, then, is because it cannot split it up—*i.e.*, hydrolyse it—into the simpler assimilable sugars as it can cane-sugar. It can excrete the enzyme—invertase—necessary to alter the cane-sugar, but it cannot form the enzyme—lactase—which would hydrolyse the milk-sugar. If it could perform this preliminary splitting up it would be perfectly well suited by feeding on the resulting glucose, as is proved by the fact that if we put our yeast into a solution containing milk-sugar together with another fungus which *can* break up this sugar, the former flourishes admirably.

This theme is so important that I must risk taxing your patience by adducing one more example. Suppose in the nutritive solution for our fungus we substituted Starch for sugar. Here we should be putting a compound of C. H. and O. where again the proportions are not remarkably dissimilar*, and, as we know, starch is an admirable food-stuff even for many Fungi—*e.g.*, *Eurotiopsis*, *Aspergillus*, *Mucor*, *Penicillium*, etc.—we may be surprised to find that our fungus may starve apparently in the midst of plenty; here, again, it is found that this is simply because the yeast cannot actively† alter the starch into assimilable sugars, for if we put in another fungus—*e.g.*, *Eurotiopsis Gayoni* or *Aspergillus Oryzæ*, which excretes abundance of diastase and quickly hydrolyses the starch to glucose, the yeast then flourishes admirably. Numerous other examples of the same kind can be given from among the Fungi, and there is no doubt as to the general application of the principles I have here illustrated by reference to simple and well studied cases, for it must be remembered that wood-fungi, leaf-fungi, etc., all need sugars and similar bodies.

It is evident, then, that in providing for the nutrition of a fungus, it by no means suffices to give it simply the necessary food-elements. The form in which these elements are combined in the food is a matter of fundamental importance. But experimental enquiry—and, as we see, the whole question is one of experiment—has resulted in the further discovery that great differences exist in the food requirements of different Fungi, even within the limits of suitable food-media, and there can be no doubt that it is as important for an Agaric to obtain the right mixture as it is for a Mould to do so.

Ordinary saprophytic mould-fungi, *e.g.*, *Mucor*, *Penicillium*, *Aspergillus*, etc., will grow admirably on such a medium as the following:

Sugar	15 grams.
Peptone	1 ,,
Di-potassium phosphate ($K H_2 P O_4$)	0·2 ,,
Magnesium sulphate	0·04 ,,
Calcium chloride	0·02 ,,

Or, employing the same minerals, we may offer the carbon and nitrogen, etc., in the form of leucin and sugar, or ammonium tartrate and sugar, or peptone alone or leucin alone, or asparagin, or am-

* The formula for starch is $xC_6 H_{10} O_5$.

† I say actively because some varieties of yeast can slowly excrete a little diastase.

monium acetate, with the result that growth occurs but is worse and worse as we go down the list. A still more accurate series of results is got by using ammonium nitrate as the source of nitrogen throughout—of course with the minerals also—and varying the source of carbon. The growth will then be found to be worse and worse as we go down the following list. Grape-sugar, cane-sugar, peptone, albumen, quinic acid, tartaric acid, citric acid, asparagin, acetic acid, butyric acid, ethyl alcohol, benzoic acid, propylamine, methylamine, phenol, formic acid.

That any fungus should be able to grow at all in some of these media is remarkable enough, and it should be noted that most of the lower numbers on the list are utterly useless to most Fungi.

Further research has shown that these common moulds can secrete various kinds of acids and enzymes, and their universal distribution and adaptation to all kinds of food-materials (heterotrophy) evidently depend on these powers. Their occurrence in the chemicals of druggists' shops, even in solutions of arsenious acid, picric acid, copper-sulphate and other poisons, the power of penetrating wood which I have shown *Penicillium* to possess, and the existence in them of proteolytic, diastatic, inverting, and other enzymes which attack proteids, cellulose, sugars, fats, etc., all go to explain their ubiquity.

What a different case seems to be presented when we turn to a parasitic fungus such as a Uredine, or other form which can only live on some special host-plant and cannot be cultivated in artificial media.

And yet the difference is more in degree than in kind, for recent researches have convinced us that the parasite contains and requires the same elements and compounds as the saprophyte, only it has had to adapt itself to certain peculiar difficulties in obtaining it.

I might perhaps compare the roving saprophyte to a vagabond in a land of plenty where, his tastes not being fastidious, he finds abundance of suitable food lying around, as our cousins say, on all hands, to be picked up without restraint; whereas the parasite has been so long used to having his food highly prepared and specially served that, although he has to enter stomata, pierce cell-walls and cause all sorts of locks, bolts and bars to fall asunder before he can get at the stored and manufactured tit-bits in the cells attacked, we must regard him as a sort of aristocrat—a burglarious aristocrat, if you like, but a highly bred and fastidious individual nevertheless.

It seems at first as if immeasurable differences separated these parasites from the ubiquitous moulds, but closer investigation raises suspicions as to the validity of such a conclusion. On the one hand it has been shown that if we inject a little sugar into a living leaf, so that an excess of this dainty is presented, even so irreclaimable a saprophytic vagabond as *Penicillium* will creep through the stomata and penetrate the leaf-passages, behaving to all intents and purposes like a parasite; moreover, it will enter the medullary rays and other tissues of wood under certain circumstances quite like a timber-parasite. Nay, it is possible to induce *Penicillium* and *Aspergillus* to penetrate epidermal cell-walls or even artificial cellulose membranes

on the other side of which an attractive food-material such as a sugar has been placed, so that our saprophyte here not only turns towards the membrane, but excretes a solvent enzyme and dissolves its way through it, and so gets at the sugar just as a parasite would do. On the other hand many parasites can be easily cultivated for years in artificial media—*e.g.*, Ustilagineæ. Yet even these very mould-fungi so remarkable for their omnivorous heterotrophy exert, so to speak, a distinct choice when two or more carbon compounds are offered them together, as shown by the fact that *Penicillium* is employed by the chemists to split racemic compounds. In other words, if *Penicillium* or *Aspergillus* is offered tartaric acid as a source of carbon, it splits this into its optically positive and negative varieties, and so long as there is optically positive acid present the fungus leaves the other variety severely alone.

Again, although *Aspergillus* can feed on glycerine, it will pick out the smallest traces of dextrose from a mixture with glycerine before attacking the latter, whereas it prefers acetic acid to dextrose in a mixture of these two although acetic acid itself is, like glycerine, a poor food.

Again, *Eurotiopsis Gayoni*, a most remarkable fungus found on boiled starch, can obtain its carbon from Dextrose, Levulose, Maltose, Lactose and numerous other such substances, and yet is totally incapable of utilising cane-sugar or Inulin, notwithstanding the close relationships of these carbo-hydrates to sugars and starches.

Many other instances can be given where a fungus selects one substance in preference to another, although the latter may be the better food-material as judged by the general behaviour of organisms towards it.

Such considerations, and numerous experiments based on them, lead to the conclusion that we cannot classify or arrange the food-materials of Fungi according to any chemical or physical scheme. Nägeli's conclusions that compounds containing C. and O. directly connected could not be assimilated, and that C. H. groups are useless unless two or more atoms of carbon are linked together, were alike premature and inaccurate, as shown by the feeding of certain Fungi on formic acid or methyl alcohol, each containing but one C. atom. Equally is it impossible to estimate the nutritive value of a food-material according to its calorific value, otherwise fat ought to be always a better food than glue, and cane-sugar better than either, whereas, as I have recently shown, *Onygena equina* refuses both fat and sugar, and demands the glue, and *Phycomyces nitens* revels in fatty oils, as was well exemplified by the enormous growths of that fungus I saw at a burnt oil mill last winter. The fact stands out plainly that we do not know what decides the nutrient value—*i.e.*, the smallest quantity of carbonaceous substance consumed by unit-weight of plant in unit of time—of any carbo-hydrate or other organic substance, and must conclude that the protoplasmic activities are so attuned to particular food-supplies that they refuse to readily change their habits—I say ***readily***, because we know of many cases where a fungus can be

gradually accustomed to new food-substances. It is interesting to note in this connection an observation of Brefeld's, which I have also confirmed, viz., that spores of coprophilous agarics which can only be got to germinate in dung-decoctions, will, when a vigorous mycelium is once started, go on growing in other food media, and other examples of the same kind are not uncommon. Thus we may have Fungi incapable of parasitism until the spores have been germinated in dead media, as I showed to be the case in the Lily Disease due to a *Botrytis*.

It appears to me that the foregoing evidence—which can be largely extended—leads to the following argument. Since the principal destiny of all the essential food-materials is to build up the protoplasm of the fungus, and since the whole of the structural peculiarities of the fungus result from the activity of the protoplasm, we must conclude that if two individual mycelia of the same species are being fed in different ways, from different sources which supply the essential constituents in different combinations, the working of the protoplasm must vary in each case, and if the protoplasm varies, the results of its activity must vary also. It does not follow that the resulting variations will be visible to us, though it can be shown that they often are visible; nor does it follow that we can predict what the variations will be, though the purely experimental enquiry, which alone can decide such matters, shows that even this can now be done to some extent, as we shall see.

The point to be emphasized for the moment is merely that if we vary the nutrition of the protoplasm—and we see this can be done within certain limits—then we vary its activities, and among such activities are results of the highest importance to the present argument, some of which may be such as our senses take cognisance of, though others will be too subtle or too transient to be noted by us.

If to variations of food-supply we add variations in the other conditions of life-activities—*e.g.*, temperature, moisture, concentration of food-materials, illumination, aeration, etc.—all of which are known to induce changes of importance, we see dimly down long vistas of possibilities, and the wonder is not that Fungi vary, but that any species is able to maintain its average standard of peculiarities and properties. Here, however, we open up questions into which there is not time to enter, and I must pass on.

If I now cast a glance at some of the curious cases of habitat and food-supply known, it must necessarily be brief and only serve to remind us of examples.

Mycophthorous Fungi are by no means uncommon. *Polyporus agaricinicola* (Ludw) on *Amanita*, *Boletus parasiticus* (Bull) on *Scleroderma*, *Volvaria Loveiana* on *Clitocybe nebularis* and the well-known cases of *Nyctalis*, *Hypomyces*, *Hypocrea*, *Cordyceps*, *Barya*, etc. etc., are cases in point.

Carbonicolous species are also abundant, as exemplified by *Flammula carbonaria*, *Cantharellus carbonarius*, *Ascobolus carbonarius* and other pezizineæ; the well-known *Peziza omphalodes* (*P. confluens*)

has turned up regularly in my laboratory during the last two years on the sterilised pots of soil used in Dr. Dawson's experiments.

The still mysterious outbreak of *Peziza aurantia* on gault clay taken from a pond in the Cambridge Botanic Gardens, described by me a short time ago, is another case in point.

Several Fungi are found on oil and fats, and Mr. Biffen, working in my laboratory, showed that a true destruction of the fat occurs. *Monascus* was found by Went on the glycerine of soap-works. *Phycomyces*, *Inzengœa* (*Emericella*) and *Cyclonium* are other examples.

The destruction of horn, feathers and similarly strikingly resistent substances by *Onygena*, *Ctenomyces*, *Ascobolus*, is even more remarkable; and I need hardly refer to the numerous coprophilous species of *Coprinus*, *Anellaria*, *Panœolus*, *Ascobolus*, etc., some of them apparently specifically peculiar to the excrement of particular animals, a point of some significance, in my opinion.

The idea seems to be wide-spread that Fungi are not common on animal substances, but apart from the cases mentioned, let me remind you of the now very long list of parasitic and semi-parasitic forms which attack insects; recent investigations render it probable that a very serious—to the Locust—epidemic disease of Locusts is due to a *Mucor*, and every mycologist is familiar with the entomophagous species of *Empusa*, *Entomophthora*, *Tarichium*, *Cordyceps*, *etc.*

Protozoa, Cœlenterata, Infusoria and other lower animals have numerous fungus enemies among the Chytridiæ and Phycomycetes. Nematode and other worms are preyed on by species of *Harposporium*, *Monospora* etc.

Fishes, Birds and higher Vertebrates also have numerous fungus parasites, of which the *Saprolegnia* of salmon disease and the *Aspergillus* and *Mucor* of lung mycosis, and the Fungi of "Ring-worm" and other diseases are best known. But even more serious affections of man and higher animals are due to Fungi, and recent investigations are bringing forward the question whether that dreaded disease, Cancer, is not due to the invasion of the tissues by a true fungus.

This must suffice, however, as there is not time to extend our list to cases including wasp's nests, honeycomb, resin, wall-papers, corks, sacking, rope, etc., as curious habitats for Fungi. Moreover, you will be able to add numerous examples yourselves.

Several questions arise from such considerations as the foregoing. How do Fungi get nutriment from such insoluble materials as feathers, insects' wings, honeycomb, wood, etc.? Are the peculiar forms found on such media permanent species, or adapted races, or varieties, on which the special conditions have had effect? Do the same species grow on several such peculiar habitats, and what determines their success on one and not on another? Why do we find a particular fungus on the dung of a particular animal, and not on that of an allied animal? Do all the spores which fail to come in contact with this peculiar medium perish; or do they give rise to sterile mycelia; or—most fateful of questions—do we give different specific names to

the same fungus growing on different media and in different conditions ?

This last question is vital, and I propose to examine it a little more closely. You are aware of the excitement which arose when the polymorphism of the Fungi, as it was termed, was first brought forward by the Tulasnes and followed up with such critical acumen by De Bary and his school. We now look on the then marvellous cases of *Sclerotinia, Eurotium, Puccinia* and many other instances with equanimity, and smile at the wild dismay of the mycologists of those days who could not see the trend of events, and that much of this polymorphism was of the same order as we should institute by having different names for corn in the blade and corn in the ear. Much more subtle are the cases with which Eriksson has now familiarised us—the varietal forms or races of *Puccinia graminis*—or which Hansen has shown to exist in the cultivated yeasts. These must be put at the other extreme as cases of, not polymorphism—because we cannot perceive the differences in form—but polyergism, if I may coin the term to express their salient features of differences in physiological activity.

Between these two extremes we are beginning to recognise that there exists a kind of polymorphism in which direct effects of nutrition are observable, and not mere differences of developmental stages.

Plenty of instances can be given of the direct effects of nutrition. Brefeld showed that if you go on growing an *Ustilago* in certain nutritive media it yields nothing but yeast-forms for months and years, and no one would suspect these to have anything in common with the *Ustilago* developed on a cereal.

Planchon's recent investigations on the effect of food-materials on *Dematium* and other Fungi lead to the same conclusions. I have myself shown quite conclusively that *Dematium pullulans* may develope in the form known as *Coniothecium* on pine sawdust, as a *Torula* on certain other solid media, as a *Yeast* in certain liquids, while the typical *Dematium* condition is regularly maintained on saccharine gelatine media, all at ordinary temperatures and growing side by side.

Equally conclusive are the remarkable results recently published by Klebs, showing that the reproduction of Fungi, and the kind of spore produced, depend in the first instance on definite conditions of nutrition. Klebs showed that it is possible to take a fungus, such as *Saprolegnia*, and cultivate it for months, and even years, on a suitable food-medium, where it grows admirably, but never produces either zoosporangia or oogonia. Klebs found that if he sowed this fungus on the following medium,

Gelatine	...	...	5 grams
Extract of Meat	...	...	2 grams
Tap water	...	...	93 cu. cm.

it grows admirably, and in two or three days formed an abundant mycelium. The same result was obtained if a bit of this sterile mycelium was transplanted by means of a needle into a solution made by boiling 5 peas in 50 c.cm. of tap water.

If a bit of this mycelium was transplanted every third day to a new vessel of the pea-extract, it also grew rapidly to a rich mycelium, and this was done repeatedly for two and a half years with the same result —not a trace of either zoosporangia or oogonia was developed; the mycelium remained completely sterile the whole time.

Yet at any period during this two and a half years it was only necessary to put a bit of the sterile mycelium into tap-water—*i.e.*, to suddenly starve it—and in a few hours it developed abundance of zoospores, whereas if he put such a piece into Agar (a gelatinous or gum-like substance obtained from certain sea-weeds), it immediately proceeded to form oogonia. If, again, the well-nourished sterile mycelium is put into 1 °/o salt solution, it forms neither zoosporangia nor oogonia, but at once developes gemmæ, *i.e.*, resting bodies consisting of jointed bits of the mycelium in which the protoplasm collects.

It would take much too long to describe all the experiments, or the precautions and proofs which led step by step to these results, but I cannot forbear just adding the explanation they give of ordinary experiences in our laboratories. When I want a stock of *Saprolegnia* for teaching purposes I float a few dead flies, black-beetles or mealworms on water; the dead bodies slowly diffuse peptone-like substances into the water and a rich mycelium rapidly radiates out from each. As long as the food-material is abundant the mycelium remains sterile; as the outflow of food-substances diminishes, however, owing to the extra demands of the enlarging mycelium, the distal ends of the radiating hyphæ begin to form zoosporangia in the less nutritious solution into which they are forcing themselves. As time goes on the starvation of the mycelium proceeds further, and now the oogonia begin to appear in those hyphæ which find too little food for zoospore-formation let alone growth.

Time will not admit of even a recapitulation of similarly decisive experiments with *Mucor, Sporodinia, Eurotium* and other Fungi, but I may remind you that we proceed quite similarly with the fungus *Saccharomyces* (Yeast). When we want spores for class demonstration we simply take well nourished sterile yeast cells, put them on a wet porous porcelain plate, and in 24-48 hours the starved cells begin to develope spores.

One striking experiment with *Sporodinia,* which developes its sporangia in air, not in water. If a strong culture is placed in each of two similar vessels, and you keep one covered by a glass plate and one open so that the evaporation partially dries the air, the latter developes sporangia and the former zygospores. Nay, if the culture is large enough and properly disposed, you can keep half the air relatively dry by moving the cover-glass so that only part of the culture is covered, and in the drier region sporangia will develope and in the wetter region zygotes. In this and similar cases the starvation necessary to spore-formation is graduated by the transpiration which the sporangiophores exhibit. Stop this, and the change in nutrition

of the hyphæ impels them to form zygospores; promote it, and they develope sporangia.

In other words, the nutritive conditions decide not only the mode of reproduction, but also whether it shall form reproductive organs at all, and this quite apart from any injury to the growth, which is often more vigorous if sterile.

Now, it is clear that although we do not know all the stages of these processes—for instance, we are profoundly ignorant of what substances pass from the mycelium into the sporangiophores and zygophores—a great step has been made in establishing, as Klebs has done, that definite conditions of nutrition are concerned in bringing about the reproduction processes, and in modifying their characters. The mere fact that in *Penicillium*, for instance, the spores contain, according to Kramer's analyses, 61·13 °/o of dry substance containing 3·09 °/o of ash, as against 12·36 °/o and 11·34 °/o respectively in the mycelium, shows that enormous changes in substance occur when the living protoplasm is impelled to produce spores, and the great accumulations of fat, nuclei, etc., in other reproductive bodies tell a similar tale. Whether we shall ever learn exactly what occurs must be left to the future, but it is obvious that the present steps in the enquiry are essential to enable us to set the further questions to be answered.

One of these questions is, how far is the development of the pileus, spores, etc., of a hymenomycete dependent on the nutritive conditions? Another is, do the conditions affect the characters of these organs? The matter is important, because we determine the species entirely from these characters.

The question now arises, Can we apply the preceding considerations to the higher Fungi, such as the Hymenomycetes?

In so far that genera and species are still accepted which are merely immature or arrested conditions of forms placed in other genera and species when complete, there can be no doubt of it. I propose myself to show you that *Naematelia* is merely an abortive state of *Tremella*, and other cases of the kind can be adduced.

In so far, also, that considerable variation occurs in the higher agarics, etc., we have grounds for raising the questions I am raising. I need only remind you of the well marked varieties of the common Mushroom both in cultivation and in the field; and at the risk of an uplifting of the eye-brows on the part of you masters of the Friesian Mycology, I venture to put to you whether the characters which differentiate extreme varieties of *Psalliota campestris* are not as striking as those which distinguish this species as a whole from *P. cretacea* (Fr) *P. silvicola* (Vitt), *P. arvensis* Schæff and *P. sylvatica* Schæff) *?*

Plenty of other instances can be selected from among those agarics which have been sufficiently studied. *Armillaria mellea* is a case in point. A good authority has said of it, "There is scarcely a plant more apt to assume different aspects under different conditions than the present one," a statement we can all confirm; and that exquisitely

beautiful species, *A. mucida*, varies from diaphanous white to olive and even black.

Marasmius androsaceus has two varieties at least, one on oak-leaves, the other on pine.

What should we do with a *Pleurotus*, the spores of which show traces of brown or lilac-pink ? Ask those who have had to do with *P. euosmus* or *P. salignus*, etc. The very same thing has occurred in *Marasmius*, several species having yellow or ferruginous spores, and Scherffel has separated these off as a genus *Phaeomarasmius*. Or let me take the group of species allied to *Hygrophorus conicus*, viz., *H. chlorophanus*, *H. psittacinus*, *H. coccineus* and *H. puniceus :* are we certain of these as species, or have we here a series of prismatically coloured forms growing on different media and in different situations and varying accordingly ?

Or, again, let me direct your attention to that group of species and varieties of which *Hypholoma fasciculare* and *H. sublateritium* are the type. Does not *H. sublateritium* with its varieties *Schaefferi* and *squamosum* merge into *H. fasciculare* and its variety *elæodes ; H. capnoides* and *H. epixanthum* coming into the alliance ? Has anyone worked here at the connection between form, colour, texture, etc., and the kind of wood and situation the fungus grows on and in ? I ask, because it has appeared to me that those growing on Conifers, on Oak, and on other stumps seem to differ.

Similar questions may be raised concerning *Collybia velutipes* and its allies; and an analysis of *Russula*, *Clitocybe*, and other genera and sub-genera afford numerous other examples.

Need I go further in citing these mycological puzzles ? Enough has been said to show that any exact knowledge of the nutrition of Fungi must count for good in the arduous task of elucidating the many and perplexing vagaries of these elusive organisms. Of course, if we choose to push the definition of a species as merely " the unit in classification designating an assemblage of organisms which, in the judgment of any writer, is so marked and so homogeneous that it can be conveniently spoken of as one thing," then it may be argued that there are as many species as there are opinions ; but it is obvious that some consensus of opinions must be arrived at if we are to have species which can be *conveniently* accepted, and what I am advocating is that the accepted species must as a mere matter of convenience be more broadly defined—not that their variations are to be ignored or denied, which would be absurd.

It does not seem likely that the more prominent morphological features, such as the mode of spore-formation, the arrangement of basidia, gills, etc., would be affected by differences in nutrition, because experience shows that when once the so-called morphogenic impulses are started, the species appears to carry them to their normal conclusions ; but it does appear very likely that such characters as texture, colour, size, excavations, compactness, viscidity, silkiness and numerous other minute characters known to be extremely variable under different conditions in other plants, may be equally incidental

in the Agarics. For we must not forget that the pileus, etc., is not a sexually developed organ; it is subject to all the so-called somatic influences that affect any vegetative structure.

It should not be overlooked, however, that conditions of growth may affect even such points as the shape of the hymenophore, as shown by Massee in *Stereum hirsutum*, in *Pleurotus*, etc. Patouillard has described a specimen of *Psalliota campestris* with cross-connected gills resembling one of the polyporei, and similar anomalies have been described in *Amanita*, *Pleurotus*, *Coprinus*, etc., and are normal in *Favolus*, *Lentodium*, *Marasmius*, etc. These cases are, of course, not to be confounded with those caused by parasites—*e.g.*, *Lactarius*.

Nor are spores exempt. Horrell has shown that the number of basidiospores in Mushrooms vary from two to four, and Brefeld and Klebs find that if the chlamydospores (macro-conidia) of *Hypomyces chrysospermus* develope in air they are covered with spike-like asperities, but if formed in a liquid they are smooth, and Biffen observed similar effects of the environment on the spores of *Acrospeira* in my laboratory. I showed long ago that *Didymium*, which has white calcified spore-cases if growing in air, loses the lime and forms black sporangia in water, and Klebs has confirmed this and shown that differences in the capillitum and stalk also result.

I do not propose to insist on these cases, however, further than to point out that it is evident we must be cautious in assuming that any characters such as those under discussion are sacred from the all-pervading influence of conditions. It has been estimated that while 30 °/o or so of the Agaricini grow on wood, the vast majority—about 64 °/o of the British species—are developed in the ground, a vague term, since it includes old charcoal beds, decaying sawdust, humus, etc., and observation shows that peculiar conditions are associated with many species. Everyone knows that the Agarics of a Beech-wood differ from those of a Pine-forest, and that many species found in pastures are not gathered in shaded situations. But more curious points arise. Why is *Amanita muscaria* so partial to the neighbourhood of Birches and Conifers; and why is *Marasmius oreades* only found among grass? I once traced the mycelium of the latter to the roots of the herbage among which it grew, and I have lately had *Stropharia aeruginosa*, a form not uncommon in pastures and woods, parasitic on the roots and rhizomes of an *Asparagus*, a point of some interest since Brefeld failed to cultivate this fungus from its spores.

These cases are not without interest in connection with the numerous instances of Mycorhiza which are now known. As you are no doubt aware, many trees, shrubs and herbaceous plants are found to have their roots either invaded by or enveloped in fungus hyphæ, and we know that some of these Fungi belong to such genera as *Nectria*, *Elaphomyces*, *Polysaccum*, *Geaster*, *Agaricus*, *Lactarius*, *Cortinarius*, etc., though for the vast majority of them the fructifications—and therefore the systematic position—are quite unknown. We have also good grounds for believing that the fungus collects mineral salts and

nitrogenous materials from the vegetable mould, and hands some of these substances on to the plant in return for carbonaceous and perhaps other organic food-materials supplied by it. In any event, it is clear that the higher plant derives benefit from this symbiotic association in proportion to that enjoyed by the fungus, and in no case is this clearer than in that of the Orchids. Bernard has shown that the reason horticulturists have such difficulties in getting many orchid seeds to germinate is because the young seedling cannot develope unless its root is infested with the proper fungus immediately it emerges —a condition not always realisable. The same worker, as also Stahl, MacDougal and others, have also extended our knowledge of other forms of Mycorhiza of late, and the main facts are no longer in serious dispute among botanists. Green plants growing in humus have either to compete with the Fungi in the soil for the salts, especially potassium and phosphorus salts, which these Fungi are so well able to collect, or they have to compromise, as it were, with these Fungi and offer them something in return for such salts. That seems to be the *raison d'être* of Mycorhiza. I find it impossible to avoid asking whether these mysterious "ground" species are not struggling to obtain their nutriment from very different materials, and under very different conditions, and whether the circumstances of their varying nutrition do not affect them.

Obviously, the most satisfactory way of deciding these questions would be to do as we do in gardens with higher plants, viz., grow the alleged varieties and species side by side and record their behaviour. It happens, however, that just this method is peculiarly difficult of application to just these particular Fungi—the Hymenomycetes. Still, we are making a beginning, and already the labours of Van Tieghem, Brefeld, Costantin, Matruchot, Biffen and myself have led to results of importance, and shown that we shall gradually learn the conditions necessary for successful cultures, and I hope that my endeavours to extend these to parallel cultures may yet lead to success. At present, however, the difficulties have appeared almost unsurmountable, for reasons at which there is time only to glimpse just now.

If we ask what are the important features in the nutrition of those Hymenomycetes which grow on wood, dead leaves, and on humus, it must be admitted that very little is known. Several workers, myself among the number, have succeeded in cultivating various species of *Stereum, Pleurotus, Collybia*, etc., from spore to spore, and Brefeld especially has brought out a number of interesting facts concerning the morphology of such cultures with which, however, we are not here concerned.

Some of these cultures are relatively easy, as Biffen, working with *Collybia velutipes* in my laboratory, showed, and as my own experience with *Stereum hirsutum* demonstrated. With others, however, the reverse is the case. I will give you two instances. Last autumn I started pure cultures of *Marasmius androsaceus* and of *Mycæna vulgaris*, and from the ease with which the spores germinated, anticipated

no particular difficulty in getting the mycelium to go through all its stages to the formation of spores again. I transferred the young mycelia from the separation-plates to large flasks containing respectively, the leaves of grass, pine, beech, oak and fern, and the sawdust of pine and of oak, the intention being to compare the growth and characters on these media. No difficulty occurred in the early stages; the mycelium "ran" excellently, and all seemed going well up to Christmas-time. From then to now, however, although growth continues, no further development has been possible. As the failures are similar in all cases, I will confine my account to *Marasmius*, the more so since Brefeld and Costantin also failed with this genus.

I tried these cultures in the dark and in diffuse daylight, as well as fully exposed at a window. I tried them at high and low temperatures, even exposing some sets to winter frost. Some were kept moist, others allowed to dry up; some well aerated, others not. To some sets of cultures I added certain moulds—*Penicillium*, *Aspergillus*, or *Dematium*—in the hope that the quicker decomposition of the leaves set up by these Fungi would accelerate matters. All of no use, apparently! In almost every case—nearly 100 cultures were tried—the mycelium ran admirably, but when it had formed a well-developed white felt-work growth ceased, and nothing further came of the matter. There the white felt or spawn remains to this day. It is alive, but will not fructify.

Meanwhile I had also cultivated the mycelium—again successfully—on various gelatine and agar media, and obtained excellent strong growths on pith saturated with extract of decomposing pine leaves and a little xylose—a sugar obtained from wood—having frequently found such pith media very useful, and thinking xylose the most likely carbo-hydrate for such a fungus. Again no result. Even after ten months I had nothing more than a well-developed sterile mycelial felt. One result seemed clear, however, namely, the mycelium grows far better on vegetable media than on animal substances, such as gelatine with dung extract, which is not surprising when we remember the natural habitat of the fungus. It is generally assumed that the Fungi on dead leaves, wood, etc., utilise the humus of the forest soil as food-material, but Reinitzer has recently shown that purified humus is useless as a source of carbonaceous food even to *Penicillium* and *Aspergillus*, but that if such humus is added to a suitable carbo-hydrate, such as sugar, the former supplies nitrogen to the fungus, whence we may infer that my experiment with xylose was not without promise.

Do the failures mean that this *Marasmius*, apparently a most pronounced saprophyte on dead leaves, is really parasitic? Do its fine vegetative hyphæ after all play the part of a Mycorhiza, and only "run" on the dead leaves to throw up the pileus, the carbonaceous material for which has been stored up after collection from the roots of some tree? At present it seems impossible to say. But the failures of Brefeld, Costantin and myself to get this fungus to fructify on (in my experiments) the very media on which it is found in Nature are significant, and, although negative results prove nothing, warrant the questions I have raised.

In the culture of *Naematelia*, to which I draw attention elsewhere, the case is different in degree only; there also the conditions for perfect spores have not been attained.

It is evident that we are profoundly ignorant of the conditions of growth of the Hymenomycetes, and that much has to be done by all of us before we know even the relative value of the characters employed in the classification of the pileus and stipes on which so much depends.

Supposing by some imperial edict it was decided to classify all the people of a nation according to the colour of their eyes as a primary step, and to put all the black-eyed, brown-eyed, grey-eyed, pink-eyed and—well, I do not know of any white-eyed people—into totally different groups; then suppose we took all the black, brown, yellow, grey and white-haired specimens of each groups and put them together, and so on. It is clear that this would not lead us to a natural classification, and if the imperial edict compelled us to bury or embalm these people according to the same principles of grouping, we should have cemeteries very like our present herbaria in principle; and what I am fearing is that our herbaria are keeping permanently apart blood relations who ought to have been in the same graves, and whose tomb-stones ought to bear the same names.

Now, it must not be supposed that I am criticising the magnificent artificial scheme of classification of Fries in any iconoclastic or carping spirit; not only am I quite incapable of reforming it—and, moreover, am strongly of opinion that it should be upheld until a constructive genius of equal ability arises to reform it—but I give way to no one in my admiration of the astounding industry and grasp of details shown by that great expert, and by the workers who have followed out and further extended his monumental work, and our English handbooks by Berkeley, Cooke, Stevenson and Massee, as well as the—to me, at least—wonderful grip of the minute characters shown by several of my friends only confirm my astonishment at the beauties of this artificial system. Still we must not forget that Fries' system has dissatisfied many reformers, as the emendations of Saccardo, Hennings, and others show. What I should like to promote is, however, a closer investigation into some of the points to see if we could not go further into these matters of species and of the causes which determine fructification, variation, etc. It is clear that something might be done by more accurate information respecting the habitats. As regards species on wood this should not be difficult, but we want to know more as to whether on living or dead wood, on Conifers or Dicotyledons, etc., on Pine, Fir, Oak, Elm, etc., and which species of each ?

As respects leaves, the matter is not so easy, but we want to know more as to whether on Pine, Beech, Fern, Grass, Moss, etc., and which species. Here difficulties occur as to whether the mycelium has merely crept on to the leaves to form its pileus, or really lives on or in the leaves—whether it is really a parasite, a mycorhiza form, or a saprophyte pure and simple.

Similarly with terricolous species, and those growing in pastures, where, however, the obstacles to accurate determination are greater still, but we have yet to learn that the existence of difficulties is a reason for avoiding a question to Nature ! It is important to know, not only whether the substratum is charcoal, burnt clay, sand, etc., but if the mycelium in open land runs into manure, humus, or even to the living roots of grasses, etc. Much has been accomplished, but more can be done by further observation in the field to direct the efforts of those who cultivate the forms with a view to settling these questions, and we must all admit that it is a branch of science that opens up splendid opportunities for research.

We should like to see more information regarding the shade-bearing, moisture-loving, wind-enduring and frost-resisting capacities of groups of critical and closely allied species, as well as statistics regarding season, altitude, habitat, etc., recorded with all the care and completeness possible. An excellent beginning has been made; why not carry it further ?

I must now conclude this series of jottings and questions, in which I fear little has been actually accomplished beyond exciting curiosity. But if I have succeeded in enlisting your co-operation in helping us to solve certain problems concerning the Hymenomycetes, much may yet come of it. Among the problems are :—What are the conditions which determine the sterility or otherwise of the mycelium ? How far are lignicolous or foliicolous forms able to adapt themselves to terricolous or coprophilous, etc., habitat ? What species are Mycorhiza forms, or parasites, or facultative saprophytes ?

Is there any connection between the habitat and nutrition of the species, and their specific and generic character, *e.g.*, colour of spores, texture of pileus, hollow or stuffed stipes, adhesion, freedom etc. of lamellæ, or minor characters of colour, silkiness, etc., ? Can we find in the distribution of the species in latitude or altitude any explanation of the variation which it is admitted occurs within the limits of accepted species ?

The answers to these and a number of other general questions which might be undertaken in the field, would be very welcome to those of us who have to wrestle with the difficult problems which the culture of these organisms present.

ON THE BIOLOGY

OF A

NÆMATELIA Fr.

By H. MARSHALL WARD, Sc. D., F.R.S., &c.

During some investigations on the Hymenomycetes which grow on Pine-leaves made last Autumn, I found on the isolation-plates a yeast-like form the behaviour of which puzzled me exceedingly.

It grows readily on wort-gelatine, showing up in two days as circular plates of a pale yellow colour which soon spread, until in ten days to a fortnight each forms a slightly raised disc an inch or more in diameter, honey-yellow and marked with radiating vein-like ridges of a deeper orange or brick red colour, all spreading like wrinkles from a central spot of the same hue (Fig. 1). I have had such discs nearly $2\frac{1}{2}$ inches in diameter on the plates. Careful examination shows that these discoid growths are very glairy or gelatinous compact masses of mycelia, but in old cultures, when they dry up, they become exceedingly brittle and almost like horn. Immersed in the mass are two kinds of bodies, yeast-cells and what I shall term chlamydospores. Examination of the pale yellow young colonies, about the second day, shows that each consists of actively budding yeast-cells (Fig. 4) radiating from a common centre and forming a pasty mass which slightly softens or liquefies the gelatine. This mass is fringed by a number of short hyphæ radiating at the margins like a fringe of cilia. (Figs. 4, 6, 8 and 13). On the third day these radiating hyphæ have increased in number, as have also the yeast-cells from which they radiate, and here and there the hyphæ show swellings along their course. (Fig. 2). Each swelling is ovoid and soon fills with oily looking drops, and becomes segmented off from the rest of the hypha by a septum at each end, or, when terminal, below only.

As the colony grows, the central core of yeast-cells increases, and the number of radiating hyphæ and their swellings augment (Figs. 8 and 9), and the older, wrinkled discoid colonies (Fig. 1) consist of many hundreds or thousands of the latter radiating out from countless yeast-cells. The older more central oval bodies have by this time obtained thicker well-defined walls and are crammed with oil-drops, and are evidently of the nature of *chlamydospores* (Fig. 3), and will be termed so in what follows.

Obviously the first step was to determine beyond doubt that the

yeast-form and the chlamydospore-form belong to the same fungus, by the separation and culture of a single yeast-cell. This was done by isolating a single cell in a hanging-drop of the wort-gelatine and watching its development hour by hour in the usual way. The results were perfectly clear and absolutely conclusive on this point, as shown in figures 4—6 and Fig. 13, 14. The yeast-cell itself is long oblong or cylindric-ovoid (Fig. 4a), and varies in size from about 3 by 1 μ to 5 by 1·5 μ or even 6—7 by 2 μ, depending on the vigour and nutrition. It is extremely delicate, and when young and active is filled with hyaline protoplasm devoid of evident granules, oil-drops or vacuoles, though these may appear later, and under certain conditions the contents may be very oily (Fig. 12).

It is quite easy to obtain the yeast-cells in pure culture, since they are at once washed out of their slimy matrix in water and can be isolated in the ordinary way.

Thus sown in wort-gelatine at ordinary temperatures, the cell buds at one end in a few hours (Figs. 4—6), and repeats the process usually at the other pole soon afterwards; each daughter-cell may then again repeat the process, and new buds arise from the parent, and so on until a small colony results. (Fig. 3 *a. b.*) It depends upon the food material, temperature and other conditions how long this budding process continues, as well as how rapid the formation and separation, etc., of the cells are. Thus in wort-gelatine at ordinary temperatures it may require three hours and less to complete a bud, whereas on a poor food-medium, or if the temperature is high—22°C and over—it may take a day or more. Compare Figs. 4—6 with Fig. 7. I may add that it is frequently the case that fungus cultures are attempted at too high a temperature, and abnormal results are obtained; it is by no means certain that in the present instance I have succeeded in obtaining the optimum temperatures, but growth goes on very well at those given.

In the course of 24 to 36 hours or so, when a small colony of yeast-cells has been formed, some of the marginal cells change their mode of growth and the buds no longer separate but elongate into radiating hyphæ—Fig. 4 *e*, Fig. 5 *e*, Fig. 6 *d*, and Fig. 6*a*. It is these hyphæ which, rapidly increasing, form the halo-like fringe around the colony (Figs. 13 and 14). Each hypha is about 1-1·5 μ in diameter, sinuous and septate, and soon branches below the septa (Fig. 14). As soon as the halo of hyphæ is well developed—*i.e.*, about the third day in good cultures—the older of them begin to form chlamydospores, by dilating at the tips into pyriform or ovoid swellings full of translucent protoplasm, in which minute oil-drops rapidly form, enlarge, and run together (Fig. 15). Very often the apex is prolonged into a short beak (Fig. 15), which may grow on and repeat the process (Fig. 2), but in other cases the terminal swelling remains rounded at the tip (Fig. 2). Every transition may be found between terminal rounded or globoid chlamydospores, with or without the beak, and intercalary ones, often in series (Figs. 2 and 3). As they get older the wall thickens and the oily-drops become more evident, often presenting a curiously striking resemblance to spores in a sporangium (Figs. 3 and

10). The ordinary reactions—solubility in alcohol, blackening in osmic acid, staining with alkanet, etc.—show beyond doubt their oily character. They vary in size from spheroids, 7-8 to 10-12 μ in diameter, to ovoids, 14-15 by 10-12 μ

It was thus established, by direct observation in hanging-drop cultures, that the yeast gives rise to the hyphæ which swell into the chlamydospores, every stage in the development of which was followed.

Attempts were then made to get the chlamydospores to germinate, but although it was possible to isolate them in hanging drops in spite of the difficulty of separating all yeast-cells—which gave trouble by growing first and over-crowding the chlamydospores—I found no trace of germination of the latter in the first state. Nor was any success obtained after heating the wort-gelatine containing the spores to 55°C for five minutes. This killed the yeast-cells, and I was able to keep chlamydospores under observation in hanging drops, but in no case was I able to obtain the slightest direct evidence of their germination. Of course they may have been killed also, though it does not appear likely.

In one or two plates of the mixed yeast and chlamydospores in wort-gelatine heated as above, a few straggling colonies did appear after a fortnight, suggesting that one or two yeast-cells may have survived the heating to 55°C.

Many other attempts were made to get the chlamydospores to germinate. Not only were they sown fresh, but also after drying, after freezing, and, as we have seen, after heating. Digestion in gastric juice was equally of no avail.

Of the media tried, in addition to wort-gelatine, I employed wort-gelatine with extract of cow-dung added; wort-agar, agar with extract of horse-dung; agar with decoction of willow-wood, with extract of rotting pine-leaves, the same with Levulose added, gelatine with beech-wood extract, etc. Also the dead leaves of pine, beech, oak, grass, fern; the saw-dust of oak and of pine; blocks of beech-wood and pine and of rotten willow, as well as the same saturated with extract of willow. Pieces of mushroom were also used. Elder-pith, saturated with Klebs' solution, or with extract of pine-water with or without xylose, in all cases without success. Nor would the chlamydospores germinate in any of the following carbo-hydrates, made up in 10 °/o solutions with yeast extract.

Saccharose, dextrose, lactose, mannite, maltose, xylose, dextrine, gum, all of which were tried at 32°C, 24°C, and at ordinary temperatures, 16-18°C, as were the other more solid media. It may therefore be concluded that either these chlamydospores require some very special conditions to force them to germinate, or they are incapable of further growth—a very unlikely view.

The yeast-form, on the other hand, grows readily on all the above media except the following : Beech-wood gelatine, elder-pith with Klebs' solution, rotten willow blocks with or without willow extract, mushroom, and the dead leaves and sawdust, on which it either refuses to grow at all or buds very sparely.

It developes most rapidly on wort-gelatine, as described, but the growth is also good on sterilised blocks of pine, where it rapidly invades the cortex and cambium, and forms the typical wrinkled thallus, but with a pinkish-orange or flesh-coloured hue reminding one of a *Tremella*, and abounding in chlamydospores of the normal form and arrangement. As the growths aged they turned pink-brown.

It also grows well on wort-agar, on agar with pine extract and Levulose, and on wort-gelatine with extract of cow-dung. The development is distinctly inferior on agar with horse-dung, or with willow extract, and on pith saturated with pine-water. This is suggestive seeing that it grows very well on agar with pine-water and Levulose, and should be compared with the behaviour on agar with horse-dung and wort-gelatine with cow-dung. Clearly the presence of wort or a sugar such as levulose promotes the growth, whereas dung extracts obstruct it. This points to its being a fungus which developes on vegetable matter and not on dung or animal substances, and is quite in accordance with its origin from pine leaves. On the carbo-hydrates made up with yeast extract, mentioned above, the behaviour was as follows.

The best growths were with dextrose, the next best with gum, and mere traces of development occurred in dextrine, lactose, xylose, mannite, maltose, or even saccharose.

The effects of temperature came out very clearly in these cultures, and I verified them in cultures on agar media and in hanging drops. At 32°C no growth at all occurred; at 22°C it was very slow and appeared not to take place above 24°C; at 16-18°C it was much better and apparently most rapid.

No signs of fermentation were to be observed in any carbo-hydrate, and since levulose and dextrose appear to suit the fungus best we may conclude that the yeast cannot invert saccharose, maltose, lactose or xylose.

Although I have had the fungus in culture for a year, no further development has occurred on any of the media under any conditions tried, and we must conclude that it is able to go on repeating its development in the form described for indefinite periods. Whether it actually does this in the forest cannot be decided, but it is obvious that it may do so.

Nevertheless I shall give reasons for believing that such would probably not occur, but that in Nature some conditions are realised—which I have failed to imitate—which would impel the chlamydospores to grow out, or germinate and complete the development of what is here an arrested form. Moreover, I think there are very good reasons for expecting that the completed form would be a *Tremella*, and that in its present arrested condition it would go into *Naematelia*.

Before doing this it is interesting to observe that the flat, yellow, wrinkled, and apparently full-grown discoid growths shown in Fig. 1 were sent to several mycologists with the request that they would give me their opinion as to the identification of the fungus. This they were kind enough to do, and I take this opportunity of thanking them. All were very guarded in their replies, at which no one can wonder,

seeing that I merely sent the thallus, in formalin or spirit, with no information as to its source, but the following genera were suggested as those to which the fungus might belong :—*Phlebia*, *Michenera*, * *Tremella*, *Nœmatelia* and *Aegerita*.

Aegerita is an old genus, established by Persoon,† and evidently refers to some imperfect form. It agrees in some respects with the present form, and especially in the size of the "spores," but the descriptions are too vague for decision. It would possibly be worth while to keep this genus of *Fungi imperfecti* in mind, however, for comparison of, say *Aegerita virens*. (Carm.) with *Nœmatelia virescens* (Corda) and *Tremella atrovirens* (Fr.) in culture, and in the light of what follows.

On looking at the other four genera suggested, one is struck by the fact that they are all Basidiomycetes, *Phlebia* being the highest, *Michenera*, generally put near *Corticium*, coming next, while *Tremella* follows with *Naematelia* close in its neighbourhood and probably merely an arrested form of it. *Phlebia*, I think, we must reject. I can find no trace of the pectinate ridges, or of the oidia which Brefeld has shown to be characteristic of the species he cultivated. At the same time there are some points of resemblance in the texture, and we still require information as to this genus. It would appear from Berkeley and Curtis' description‡ that the present fungus is not *Michenera* (B & C)—*Artocreas* (B &C).‖ Not only is the hymenium of the latter quite different, but the spores are twice the size, and there is no mention of the gelatinous consistency, wrinkled surface, etc. We may therefore conclude that this tropical genus is still unrepresented in Europe.

Patouillard (*Remarques sur l'organisation de quelques champignons exotiques*). Bull de la Soc. Mycol. de Fr. T., vii., 1891, p. 42) examined *Michenera artocreas* (Berk and Curt) from Cuba and N. America, and decided that it should be removed from the Thelephoreæ, and even from the Basidiomycetes, and regards it as a particular type of Uredineæ, comparing it to *Uromyces*, etc. He makes no mention of any yeast-form, and bases his opinion entirely on the adult structure. In the absence of more convincing evidence we must reject this view.

Brefeld§ remarks that the genus *Naematelia* (Fr.) must be merged in *Tremella* since it was distinguished only by its rounded basidia, a character he claims for the true *Tremella*. He also remarks that *Naematelia* forms yeast-conidia, and that Fries had already made the observation that basidia had been mistaken for spores in this genus. Fries' words are "*sporophoris pro sporis sumtis*." ¶

* I owe to the courtesy of Mr. Massee the suggestion that the fungus might possibly be a *Michenera* rather than a *Naematelia*.

† Persoon Disp. Fung. p. 40.
‡ Journ. Linn. Soc. Vol. x. 1869, p. 333.
‖ ,, ,, ,, ,, xv. 1877, p. 83.
§ *Untersuchungen*, &c. H, VII. 1888, p. 107.
¶ Hymenomycetes Europ. 1874 p. 696.

It is also interesting to note that Tulasne had thrown doubts on the existence of the genus *Naematelia**, pointing out that the immature globoid basidia of *Tremella mesenterica* had been mistaken for spores, and if we look at Tulasne's figure 4, plate 11, the vertical section of a young *Exidia* there depicted shows very clearly how such a mistake might be made, and exhibits astonishing resemblances to the form I have described.

If we examine Brefeld† and Moeller's‡ results of the cultivation of *Tremella*, very suggestive ideas as to the significance of the yeast-form are to be obtained, for Brefeld found that all the species of *Tremella* have these secondary organs of propagation.

If we now turn to Brefeld's figures‖ of the "yeast-conidia" of *Tremella*, it must be confessed that the much more rounded forms are different from those I have obtained in my cultures; nor do the sizes agree, a point probably of less importance since, as we have seen, the dimensions vary considerably. On the other hand, the characters of the colonies—*e.g.*, Pl. viii., Fig. 16—are in some cases strikingly similar, and the growing out into hyphæ, radiating from the colony, is quite similar—c.f. Brefeld's Figs. 16. 2 and my Figs. 5 *e* and 6 *e*—a point of no small significance in my opinion.

If this view is correct, we have the interesting fact that the basidia of a fungus such as *Tremella* may become arrested, their protoplasm filled with stores of oil, and their walls thickened in the manner characteristic of chlamydospores. The fact remains, however, that I have never succeeded in getting these chlamydospores to germinate.

* Ann. des. Sc. Nat. 1853 Ser. iii. T. 19 p.p. 203–4.
† Brefeld *Unters.* H. VII. 1888, p. 106.
‡ Moeller *Protobasidiomycetes* 1995, p. 99,
‖ Unters. H. VII. 1888, pl. vii. and viii.

DESCRIPTION OF FIGURES.

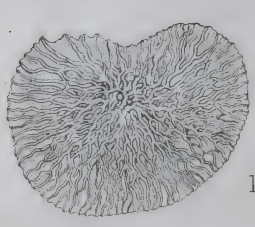
Fig. 1. An old colony on wort-gelatine.* Nat. size. In colour it was deep orange yellow.

Fig. 2. Part of the extreme margin of the same, showing the chlamydospores and a few yeast-cells immersed in mucilage × about 400.

Fig. 3. Thoroughly ripe chlamydospores from the older parts of the colony, showing the oily contents and firm cell-walls × about 1,000.

Fig. 3. (*a*) A chlamydospore and two yeast-cells isolated in wort-gelatine in a hanging-drop at 12 noon on Dec. 14; (*b*) the colonies resulting from the growth of the yeast at 11.15 on Dec. 15. The chlamydospore showed no signs of germination then or later. × about 800.

* This drawing was kindly made by Miss Dawson D.Sc. The others are by the author.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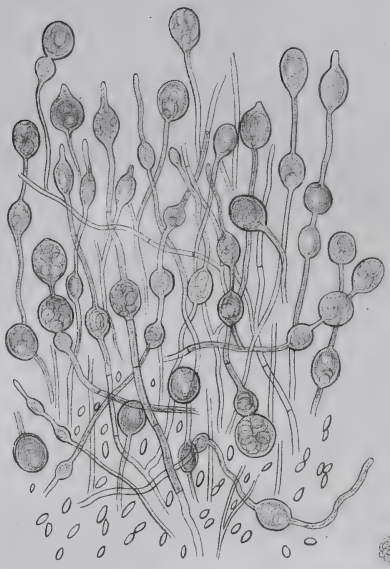
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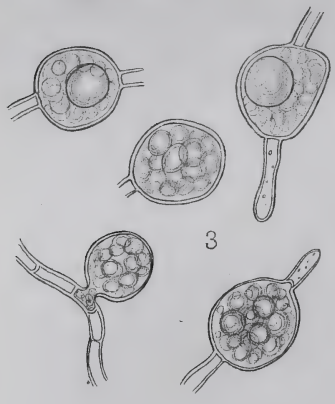
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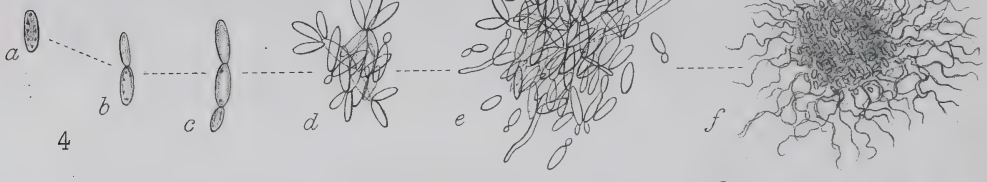

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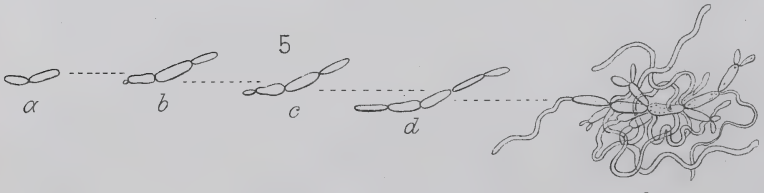

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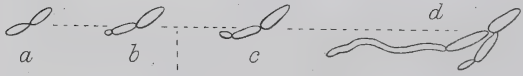

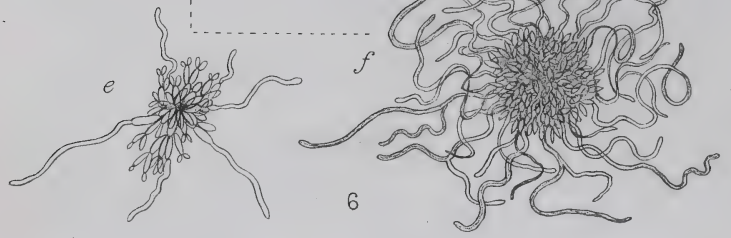

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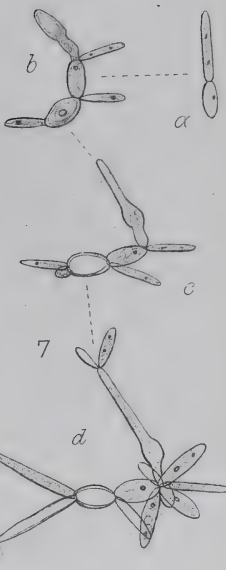

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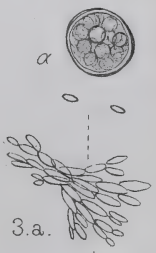

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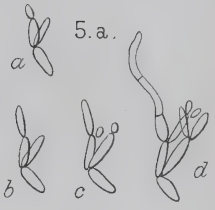

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West, Newman lith.

Fig. 4. A single yeast-cell isolated in a hanging-drop of wort-gelatine was fixed (*a*) at 12 noon; at 9 p.m. it had budded off another cell (*b*); at 12 p.m. (*c*) a second bud had formed at the opposite pole. Next morning at 9.30 a rapidly growing colony was formed (*d*), which at 2 p.m. (*e*) showed signs of outgrowing hyphæ. At 10 a.m. on the day following the much larger mass of budding yeast-cells was surrounded by a fringe of wavy hyphæ, t. 18°C falling to 14-15° during the night. *a-e* × about 800; *f* × about 30.

Fig. 5. A similar series, *a* at 12.20, *b* at 3 p.m., *c* at 3.30, and *d* at 8.20 p.m. At 10 a.m. next day the colony (*e*) was putting out hyphæ, clearly traceable to the yeast-cells. Culture in wort-gelatine at ordinary temperatures, as before. × about 800.

Fig. 6. A similar series, showing still more clearly that the hyphæ spring from the yeast-cells; *a* at 12.30, *b* at 3.10 p.m., *c* at 3.40, and *d* at 8.30 p.m.; *e* at 9 a.m. next day, *f* at 4 p.m. Medium, temperatures and magnification as before.

Fig. 7. A similar culture, in wort-gelatine as before, but at a higher temperature—22-23°C. The yeast-cell was isolated at 12 noon on Dec. 14, and at 11.15 a.m. on Dec. 15 had only developed as in *a*; *b* shows its condition at 11.30 a.m. on Dec. 16, and since it had only grown to the stage shown at *c* by 2.45, and remained stationary at 4.5 p.m., the temperature was reduced to 17·5-17°C. At 11.30 next morning (Dec. 17) it was recovering its activity (*d*) and thence grew as rapidly as the specimens shown in Figs. 4-6. Magnification as before.

Fig. 8. A colony on wort-gelatine at ordinary temperatures on the fifth day. It is still actively growing, and has only just begun to form chlamydospores in the central older portions × about 30.

Fig. 9. A colony the same age on wort-gelatine and extract of cow-dung. It has already finished its growth and has numerous ripe chlamydospores all over × about 30.

Fig. 10. A group of ripe chlamydospores from the last culture × about 800.

Fig. 11. Irregular growth and imperfect chlamydospores forming at 24°C × about 400.

Fig. 12. Extremely fatty contents of chlamydospores and yeast-cells from a three weeks' culture on pith with pine extract and xylose. The growth was poor, and many irregular imperfect chlamydospores are forming. × about 800.

Fig. 13. A colony 3 days' old in dilute wort-gelatine at 16°C from a yeast-cell which had been exposed outside and repeatedly frozen (on wort-agar from Dec. 29 to March 2). The growth was rapid and strong, and numerous chlamydospores were already formed on the older parts. × about 50.

Fig. 14. Part of the margin of the same colony, showing the mode of

growth and development of the chlamydospores. × about 1,000.

Fig. 15. Successive stages in the development of a chlamydospore at the margin of the same colony; *a* at 11.50, *b* at 3.30, *c* at 5.10, and *d* at 8 p.m. × about 1,000.

Fig. 16. Transverse section across a colony such as Fig. 1, showing the ridges covered with chlamydospores and yeasts embedded in a gelatinous mass, and the hyphæ below similarly gelatinous. Hardened in Keiser's fluid and stained with Haematoxylin × about 80.

Fig. 17. Part of the lower portion of the mycelium of last preparation × about 400, showing hyphæ embedded in gelatinous matrix.

Fig. 18. Part of a ridge of Fig. 16 showing chlamydospores and their hyphæ embedded in jelly. × about 400.

FUNGI NEW TO BRITAIN.

By Annie Lorrain Smith.

Entomophthora Pooreana A. L. Sm. Journ. Roy. Micros. Soc. 1900, p. 442, pl. iii., fig. 1.

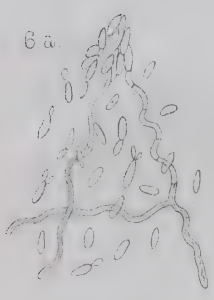
Hyphæ abundant, interwoven, breaking up into short lengths, varying in width from 5 μ upwards, septate; resting spores formed in an intercalary manner on anastomosing hyphae, globose, varying from 25 μ to 40 μ in diameter, with a thick yellowish epispore and granular contents.

Found in the tissue of a rabbit that had been buried in a garden at Isleworth, about 3in. beneath the surface of the soil, until almost disintegrated.

Oospora coccinea Sacc. and Vogl. Syll. Fung. Vol. IV., p. 21.

Tufts minute, separate or confluent, brick-red to vermillion, fertile hyphæ erect or spreading, lax or intricately compact in the mass, sparingly and irregularly branched, straight or slightly wavy, paler than the conidia, 100-140 μ long by 4-6 μ thick below, thicker and somewhat moniliform above, preparatory to the formation of conidia; conidia plentiful, globose, 11 μ to 18 μ in diameter, brick-red, in simple or branched chains.

On cat's dung, Halifax, 22nd February, 1899. Naturalist, Jan. 1900, p. 8.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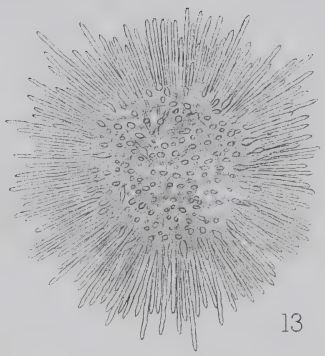
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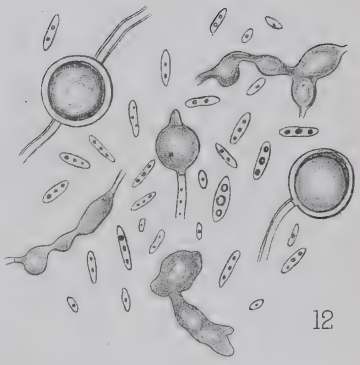
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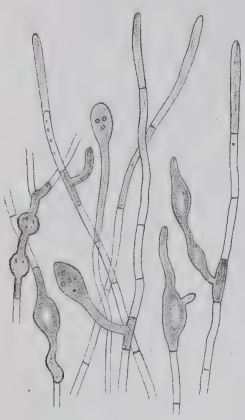
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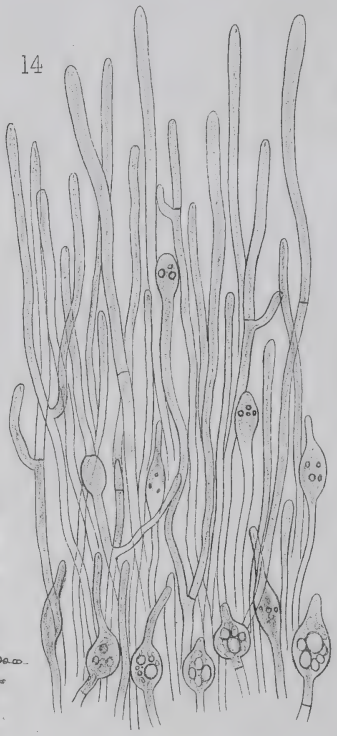
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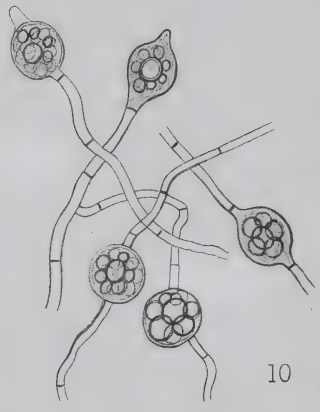
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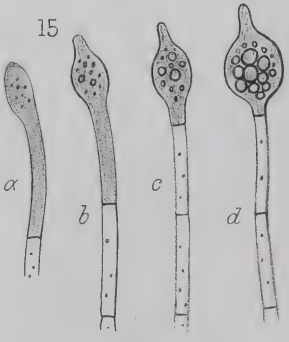
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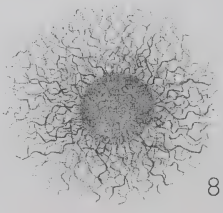
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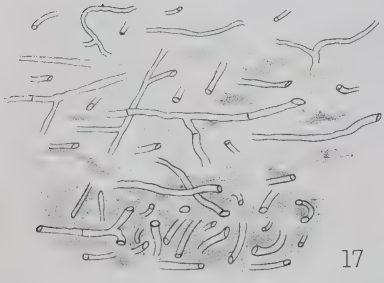
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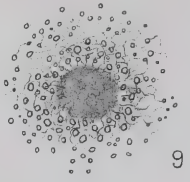
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Œdocephalum glomerulosum Sacc. Syll. Fung. Vol. IV., p. 47.

Tufts gregarious, rose-coloured; fertile hyphae ¼ mm. long, septate, cylindrical, slightly attenuated upwards, the apex terminating in a verrucose vesicle; conidia large, ovate 25 × 12 μ, pallid rose-coloured, with an apiculate base, forming a subsphaerical head.

Growing on *Tubercularia* and *Sclerotia* on branches of trees. Found in Mulgrave Woods, Yorkshire, September 1900. Mr. C. Crossland.

Botrytis dichotoma Corda. Ic. Fung. I., p. 18, fig. 244.

Tufts minute, fugacious, whitish cinnamon coloured; fertile hyphae erect, dichotomous, spreading, terminal branches, obtuse slightly curved inwards, colourless; spores numerous spherical, cinnamon-yellow.

Found by Mr. Greenwood Pim on a decaying stem in his garden, Co. Dublin. Irish Nat., p. 98, 1900.

It is to be regretted that Mr. Greenwood Pim did not complete the defective description of this interesting fungus.

Fusicladium pyrinum Fckl. Symb. Myc., p. 357.

Forming effused, velvety, rusty-brown spots; mycelium spreading just under the cuticle, finally penetrating and blackening the tissue; conidiophores upright, short, nodulose, irregular in form, denticulate at the tips, usually about 20 μ in height; conidia ovate-fusiform, 15-30 μ by about 7 μ, one-celled, brownish-yellow, smooth, solitary, or two or more on the same conidiophore.

Parasitic on the leaves and fruit of *Pyrus communis*, Worcester and Hereford. June 1900. Journal of the Royal Microscopical Society, 1900, p. 424.

Helminthosporium gramineum Rabenh. Herb. Myc. 332.

Forming elongate pallid spots with a brown edge, fertile hyphae solitary or in clusters, erect, often angularly bent, brown; conidia yellowish-brown, straight, cylindrical, 1-5 septate, 50-100 × 14-20 μ.

On leaves of barley, from Hertfordshire.

Aleuria albida Gillet. Discom. p. 36, with plate.

Ascophores 2-3 cm. diam., disc concave, stem short, even, margin spreading, fleshy-cartilaginous (not fragile), pale wax yellow, exterior albo-furfuraceous of little heaps of loose, sub-globose, thick-walled detached cells; asci cylindrical, apex sub-truncate 200-220 × 9-10 μ, spores occupying less than half the space when mature, obliquely uniseriate, elliptic, hyaline, smooth, 10-12 × 7-8 μ; paraphyses linear, or apex slightly swollen, septate, longer than the asci.

Warehouse yard, Halifax, June 1895, and Sept. 1896. Collected by Mr. H. T. Soppitt. Mr. Crossland. Naturalist, Jan. 1900, p. 7.

Barlaea Persoonii Sacc. Syll. Fung. VIII., p. 117.

Ascophore sessile on a narrow base, hemispherical then expanded, disc plane or undulate, 4-8 mm. across, wholly pale-dingy amethyst, glabrous, margin rather obtuse, flesh waxy-brittle 1·5-2 mm. thick; excipulum parenchymatous, cells globose or elongated 35-60 μ (longest diameter), hyaline, cortex thin of not more than 1-2 layers of globose cells 20 μ in diameter; hypothecial cells small and almost indistinguishable in outline; asci cylindrical, 200-210 × 13-14 μ, apex rounded, pedicel narrow; spores eight, uniseriate, hyaline, spherical, rough, 1-2 guttulate, 9·5-11 μ in diameter; paraphyses cylindrical, simple or branched, septate, hyaline, 3-4 μ thick, apex always curved.

Hebden Bridge, July 1899, Mr. Needham. Mr. C. Crossland in Naturalist, January, 1900, p. 9.

Mollisia betulicola Rabenh. Krypt. Flora I., part 3, p. 538.

Apothecia small about $\frac{1}{2}$ mm. across, gregarious on whitened spots, sessile, at first closed, globose, then open, and disclosing the pale-reddish or yellowish disc; the exterior black, scabrid or substriate, the margin slightly lacerate; asci oblong or clavate, acuminate at the tips, attenuated downwards to the stalk 56 × 8 μ, 8-spored; spores obliquely 2-seriate, oblong, obtuse at both ends, colourless, guttulate, 8-10 × 3 μ.

On decaying birch leaves, Hebden Bridge, Yorkshire, June 1899. Collected by Mr. J. Needham. Naturalist, Jan. 1900, p. 7.

Dasyscypha Richonii Mass. = *Trichopeziza Richonii* Sacc. Syll. Fung. Vol. VIII., p. 415.

Ascophores minute, ·2-·5 mm. wide, gregarious, entirely red, hairy, sessile, fleshy, cup-shaped, the exterior and chiefly the margin covered with pointed septate hairs 50-120 μ long, 3-5 μ thick at the base, thinner at the apex; paraphyses delicate, filiform, sparsely septate, not thickened at the tips, colourless about 2 μ thick; asci broadly clavate, 8-spored 40-45 × 9 μ; spores minute elliptical-fusiform, biguttulate 5-7 × 2-2·5 μ.

On rotten wood. Found in Mulgrave Woods, Yorkshire, Sept. 1900. Mr. Gibbs. Naturalist, Nov. 1900, p. 341.

Belonium Sacc. Consp. gen. Disc., p. 7, 1884.

Apothecia sessile or shortly stalked, waxy-leathery, saucer-shaped, when dry rolled inwards and closed, black or brown, smooth or somewhat downy, the margin often with short black projecting hyphae; asci elongate 8-spored; spores elongate-fusiform or elliptical, 2-many-septate, colourless; paraphyses thread-like.

B. pilosum Crossl. Naturalist, Jan. 1900, p. 6, pl. 10, figs. 7-13.

Apothecia scattered, gregarious or crowded, sessile, subglobose, becoming plane, margin raised, whitish, 1-1·5 mm., rarely 2 mm. broad, the margin and exterior pilose-papillose, silvery-grey above, brown at the base; disc blackish-grey; hairs clavate, 1-2 septate, 25-30 × 8-10 μ, pallid brown with a colourless apex; hypothecium of delicate filaments radiating from the base to the margin, excipulum composed of subglobose cells, 7-9 μ in diam.; asci cylindrical-clavate, with a narrow round thickened apex, that stains with iodine, 8-spored, 70-80 × 8 μ, spores 2-seriate above, 1-seriate below, fusiform or cylindrical-fusiform, straight or slightly curved, 3 septate, 18-24 × 2-5 μ; paraphyses cylindrical, 3·3-5 μ thick.

On one year old stems and leaves of *Carex pendula*. Elland, near Halifax, May 1890.

Ascobolus stictoideus Speg. Mich. I., p. 474.

Ascophores loosely gregarious or scattered, immersed, minute, with a torn slightly projecting margin scarcely $\frac{1}{2}$ mm. across, externally watery-white, the disc pallid-olivaceous, punctuated by the projecting asci; asci few, 5 to 10 in number, 150-160 × 40 μ clavate-saccate, shortly and thickly stalked, with a thick membrane at the apex, 8-spored; paraphyses septate, curved at the apex; spores bi-seriate or irregularly uniseriate; elliptical, 25 × 14 μ, at first colourless, smooth, then violet, minutely and densely verruculose, becoming brownish rose-coloured.

On dog's dung. Halifax, Feb. 1899. Coll. Mr. H. T. Soppitt. Naturalist, Jan. 1900, p. 8.

Ascobolus minutus Boud. Bull. Soc. Myc. IV., p. XLVIII., t. II., f. 1. Naturalist, Jan. 1900, p. 8.

Gregarious or scattered, minute, 0·5-0·7 mm. across, brown, obconical or hemispherical, then lenticular, exterior smooth, tawny, disc plane or convex, asci slightly projecting, forming black papillae; paraphyses septate, subclavate at the apex, 5-7 μ across; asci minute 8-spored, 140-170 × 13-14 μ; spores minute, elliptical, violet then dark brown, longitudinally striate, the lines scarcely anastomosing 13-15 × 7-9 μ.

On dog's dung. Hebden Bridge, July 1899, Mr. Needham.

The asci being comparatively slender the spores remain uniseriate until ejected.

Gymnoascus ruber van Tiegh. in Bull de la Soc. bot. de France, Vol. 24, 1877.

Clusters cushion-shaped, the colour of red sealing wax mostly coalescing and forming a continuous layer; hyphae irregularly branched, much entangled, with rather delicate walls; asci spherical

10-12 μ in diameter, 8-spored; spores globose-orbicular 4·5-5·5 μ in diameter; conidiophores rising both from the asci-bearing and enveloping hyphae, bearing above verticillate branches with chains of loosely-attached oval conidia at the tips.

On dog's dung. Llanymawddwy, N. Wales, Sept. 1900.

G. verticillatus A. L. Sm. Journ. Roy. Micros. Soc. 1900, p. 423, pl. iii., fig. 2.

Fruit composed of loose, deep-brown hyphae, the outer ends free, thick walled, with regular verticils of 4 curved blunt branchlets up to 15 μ in length and about 5 μ in width, the inner ends narrower, irregularly branched, the branches somewhat angular, the whole forming tangled clumps; ascus-like groups of spores somewhat oblong 10 $\mu \times 7$ μ, dark-coloured; spores minute, globose, about 2·5 μ in diameter.

On the bones of a dead rabbit that had been buried under a tree, in a garden at Isleworth, for about a year. The asci were evidently quickly evanescent, but many groups of 8 spores closely compacted were scattered about.

Thielavia Zopf. in Sitzungsber d. Botan. Ver. d. Prov. Brandenbg., June, 1876, p. 105.

Perithecia globose, without appendages and without an ostiole; asci 8-spored, short and broad, evanescent, no paraphyses; spores brown, one-celled; conidia formed terminally in chains and also endogenously in the hyphae.

Thielavia Soppittii Crossl. Naturalist, Jan. 1900, p. 7, pl. 10, figs. 4-6.

Perithecia scattered or sub-gregarious, superficial without a stoma, subglobose, red-brown, fragile, membranaceous 250 μ in height; asci elliptical or ovate, evanescent, 56-60 $\times$ 35 μ; spores somewhat elliptical unequal-sided; epispore thick, hyaline yellow, then opaque-brown, granular within, 28-30 $\times$ 16 μ.

Near the base of decaying stems of *Carduus palustris*. Norland, near Halifax. Coll. Mr. H. T. Soppitt, Nov. 1899.

Sphaerotheca Mors-uvae Berk. & Curt. in Grev. IV., p. 158.

Mycelium dense, rather thick, forming spots on the leaf with a white margin, dusky-brown at the centre; perithecia minute, numerous, scattered, black, globose-applanate, wrinkled, at length emerging from the mycelium; spores 15 μ long.

On leaves and berries of gooseberry. Ireland. Mr. E. Salmon.

Hypocopra Scrignanesis H. Fab. Sphaer. Vaucl., p. 77.

Perithecia scattered, superficial, black, cylindrical-conical, wrinkled

1 mm. high and ½ mm. across, the apex somewhat depressed, pierced by a small pore; asci cylindrical 4-spored, long-stalked 250-300 μ long; paraphyses filiform numerous, often forked; spores elongate-fusiform or elliptical, one-celled, colourless, 9-12 μ × 3 μ.

On rabbit's dung. Hebden Bridge, Yorkshire, July 1899. Coll. Mr. J. Needham. Naturalist, Jan. 1900, p. 8.

Coniothyrium Boydeanum A. L. Sm. Journ. Roy. Micros. Soc. 1900, p. 423, pl. 3, fig 3.

Perithecia in small groups or scattered, developed on the inner bark and bursting the cuticle, somewhat lentiform 300 μ × 200 μ, parenchymatous, surrounded by a few loose hyphae, yellow-brown; spores globose-ovate, usually about 12 μ in diameter, but varying to 15 μ × 10 μ, colourless, then dark smoky-brown, smooth, with granular contents.

On dead branches of *Fuchsia*, collected at Sea Mill, Ayrshire, by Mr. D. A. Boyd, Oct. 1899.

Libertella blepharis A. L. Sm. loc. cit., pl. iii., fig. 4.

Pustules of one or several cavities beneath the outer bark, the spores escaping by a wide opening, and forming a milk-white layer on the surrounding bark; sporophores erect, slender, branched, slightly stouter and of denser contents than the spores; spores filiform, curved, sometimes strongly falcate 25-40 μ × 1·5 μ.

On dead branches of *Prunus cerasus* and *Pyrus malus*. Ayrshire, Oct. 1899. Mr. D. A. Boyd.

L. corticola A. L. Sm. loc. sit., p. 424, pl. iii., fig. 5.

Pustules forming effused whitish spots under the outer bark, the spores escaping and forming a milk-white layer; spores straight or slightly bent, colourless 20-25 μ × 1·5 μ, borne on closely packed sporophores that line the irregular infolding tissue of the pustule.

On dead branches of *Pyrus communis*. Ayrshire, Sept. 1899. Mr. D. A. Boyd.

L. Ribis A. L. Sm. loc. cit., pl. iii. fig. 6.

Forming lentiform, effused pustules under the outer bark, bursting the cuticle and the spores oozing out in a gelatinous pinkish mass; spores much curved, sometimes forming a complete semi-circle, 30-40 μ × 1 μ, colourless.

On branches of *Ribes rubrum*. Ayrshire, Oct. 1899. Mr. D. A. Boyd.

L. Salicis A. L. Sm. loc. cit., pl. iii., fig. 7.

Pustules formed in the cortex, convex or triangular in section,

causing slightly elevated reddish-coloured spots on the bark; spores curved, 25-35 $\mu \times 1{\cdot}5\ \mu$, colourless.

On dead branches of *Salix cinerea*. Ayrshire, Autumn 1896. Mr. D. A. Boyd.

Colletotrichum Corda.

Pustules innate-erumpent, applanate, disciform or elongate, black, surrounded by black setae; spores fusiform, continuous, colourless, on short fasciculate sporophores.

C. Lycopersici Chester.

Growing on depressed, circular spots, which afterwards become irregular and confluent; pustules abundant, densely gregarious, rusty-brown to black, applanate, 95-150 μ in diameter; setae abundant, dark-brown, generally curved, rarely undulate or straight, often geniculate in places, gradually tapering, septate 65-112 μ long, about 5 μ thick at base; spores oblong, ends sub-acute 18-20 $\times$ 4 μ on short, slender sporophores arising from a well-developed stroma.

On fruit of cultivated tomato. Found on potato haulms in a field near Worcester, Aug. 1900. Also in a garden, Lythe, Yorkshire, Sept. 1900. The diseased stems are blackened as if scorched. Mr. Crossland in Naturalist, Nov. 1900.

Lactarius glaucescens Crossl. Naturalist, Jan. 1900, p. 5, pl. 10, figs. 1-3.

Milk acrid, copious, white, at length glaucous-green; pileus fleshy, rigid, 4-6 cm. broad, convex, umbilicate-depressed, smooth, dry, not zoned, whitish or cream-coloured with small yellowish spots, margin involute, without striae; flesh white, compact, about 8 mm. thick, 2 mm. thick at the margin; gills adnate, crowded, sometimes furcate, narrow, 1·5 mm. broad, the same colour as the pileus; stalk 2·5-3 cm. long and 1·25 cm. thick, solid, widening upwards, smooth, the same colour as the pileus; spores colourless, globose, minutely echinulate, 6-7 μ in diameter; cystidia cylindrical or subclavate, with granular contents, 50-60 $\times$ 7-8 μ.

Wade Wood, Luddenden-dean, near Halifax, Aug. 1899. Mr. James Needham.

Crepidotus putrigenus Berk. & Curt. Ann. & Mag. of Nat. Hist., Ser. 3, Vol. IV., p. 292, 1859.

Imbricate; pileus subreniform, 12-19 mm. broad, whitish, tomentose, beset at the base with a delicate white tomentum; gills broad, whitish, becoming ferruginous-brown; spores subglobose, 7 μ in length, ferruginous.

On damp wood. Found in Mulgrave Woods, Yorkshire, growing from the sides and sawn end of a log almost buried in bracken, Sept. 1900.

*Collybia retigera** Bres. Fung. Trid., p. 8, pl. iv. (1881).

Pileus fleshy, thin campanulate, then expanded, more or less umbonate, dry, glabrous, pallid, centre with a tinge of tawny brown, 3-6 cm. across, margin striatulate, surface of pileus with a more or less developed network of anastomosing veins, especially when old ; gills rather broad and ventricose, pallid, margin fimbriate, stem almost equal, pallid, minutely downy at the base, solid or stuffed, 4-7 cm. long, spores elliptical 5-6 × 7 μ.

Roots of ash tree, S. Austria.

The net work on the pileus becomes more visible after the plant has been gathered. Habitat near base of beech stump, Home Farm, Grange Park, Alresford, Hants, 15th December, 1900. Rev. W. L. W. Eyre.

Collybia veluticeps Rea.

Pileus 3-6 cm. broad, fulvous tawny, convex at first then expanded, *velvety;* flesh pale then yellowish, thick at the centre but attenuated at the margin which remains for some time involute. Stem 4-7 cm. long × 5-15 mm. thick, stuffed then hollow, of the same colour as the pileus but paler above, *fusiform* extending into the long rhizomorphoid abundant mycelium, *striate*, only slightly velvety at the thickest part, flesh somewhat rufous at the base. Gills 5-8 mm. broad, deep ochre, sinuato-adnate, distant. Mycelium *cordlike, branched and proliferous.* Spores 7-8 × 3-4 μ oblong.

Caespitose. Found by Mr. W. H. Edwards growing in the interior of an old rotten elm stump, Northwick, Worcestershire, 19th January, 1896.

Distinguished by its velvety pileus, striate, fusiform, fasciculate stem, which is only slightly velvety at its thickest part and the cord-like branched proliferous mycelium.

Mycena carneosanguinea Rea.

Pileus 2½-3 cm. broad, livid grey tinging to rufous at the umbo, becoming paler when old, convex, sub-umbonate, smooth, flesh moderately thick at the centre gradually attenuated to the margin, white then *changing to blood red.* Stem 4 cm. long × 5-9 mm. thick, grey, yellowish and incrassated at the base, hollow, flesh at the apex tinged blood colour, at the base white and with short mycelial strands attached thereto. Gills 5 mm. broad, dull purplish brown, edge dark purple and denticulate, broad in front and adnate. Spores elliptical 4-5 × 2-3 μ.

On the ground, Raincliffe Woods, Scalby, Yorkshire, 31st August, 1894. Distinguished amongst the Callodontes by the flesh turning to blood red on section.

* By the generosity of our member, the Rev. W. L. W. Eyre, we now place the reproduction of this species of Bresadola before our Members.

Coprinus squamosus Morg. Jour. of Cincinnati Soc. of Nat. Hist., Vol. VI., 1883, p. 174, pl. 8.

Pileus somewhat membranaceous, ovoid, then expanded, cinereous, *covered with reddish-brown scales*. Stem hollow, rather equal;—below the annulus *covered with reddish-brown scales* like those of the pileus;—above the annulus, smooth and white. Gills free, ventricose, white, then reddish-brown, finally black. Spores cymbiform 9-10 × 5 μ.

Growing about old stumps and trees in woods. Caespitose, pileus about 1 inch in height, expanding to a diameter of $1\frac{1}{2}$-$2\frac{1}{2}$ inches, then split and revolute. Stem 4-6 inches long, about $\frac{1}{4}$ inch in thickness. This species is readily distinguished by its persistent reddish-brown scales upon the pileus and lower part of the stem.

At the base of Elms, Hanbury Park, Worcestershire, 28th September, 1900. Collected by Mr. Carleton Rea.

The following Members have joined the British Mycological Society.

Balfour, Professor Isaac Bayley, M.A., M.D., F.R.S., Inverleith House, Edinburgh.

Boston, The Mycological Club, Boston, Massachusetts, United States of America.

Macfie, Mr. John William Scott, Rowton Hall, Chester.

Mackenzie, Mr. D., 12 James Ward Street, Glasgow.

OFFICERS FOR THE SEASON 1899–1900.

President: H. Marshall Ward, D.Sc., F.R.S., &c., University Botanical Laboratory, Cambridge.

Hon. Secretary and Treasurer: Carleton Rea, B.C.L., M.A., 34, Foregate Street, Worcester.

THE EXETER FORAY.

23rd to 28th September, 1901.

The fifth annual week's Fungus Foray was held at Exeter, where the Governors of the Royal Albert Memorial College had kindly placed a room at the disposal of the British Mycological Society. This room was constituted the headquarters, and there the specimens collected from day to day were set out, the Presidential and other papers read, and the business of the Society transacted.

On Monday, the 23rd of September, the members assembled at Exeter, and in the evening at the headquarters found a few exhibits on the tables, viz., *Lepiota leucothites* Vitt., collected by the Rev. W. L. W. Eyre. *Amanita Vittadinii* Morett.; *Boletus aurantiporus* Howse., *radicans* Pers. and *Cronartium ribicolum* Dietr., collected by Dr. C. B. Plowright. *Lactarius controversus* Fr., collected by Mr. J. Rose. *Volvaria bombycina* Schaeff., collected by Mr. C. T. M. Plowright, and *Geaster fimbriatus* Fr., *Tricholoma scalpturatum* Fr. and *Sparassis crispa* Fr. (the two latter from Dawlish) collected by Mr. C. Rea.

On Tuesday, the 24th of September, the Newton Woods at Saint Cyres were explored, and subsequently the Squire and Mrs. E. H. Quicke kindly entertained the members to tea.

In the evening the Society's dinner was held at the Rougemont Hotel, and at the headquarters afterwards Professor H. Marshall Ward, D. Sc., F.R.S., delivered his Presidential address, entitled, "Some Methods employed in the investigation of Fungi." (See p. 166).

On Wednesday, the 25th of September, the Whitestone Woods, near Newton Saint Cyres, were carefully searched. Dr. C. B. Plowright found growing on birch *Femsjonia luteoalba* Fr., a genus of the Tremellineæ hitherto unrecorded for Britain, and Mr. Biffen secured *Hymenogaster tener* Berk.

In the evening the business meeting of the British Mycological Society was held at the headquarters. Professor James W. H. Trail, M.D., F.R.S., was unanimously elected President for the ensuing year, and Mr. Carleton Rea, B.C.L., M.A., Hon. Sec. and Treasurer. It was also resolved that the office of Vice-President should be created and the rules altered accordingly, and Dr. C. B. Plowright was unanimously elected to that position. The Hon. Secretary was

further directed to make the membership cards date for one year only, and not from season to season as had previously been done.

The invitation of The Woolhope Naturalists' Field Club to hold their next annual week's foray at Hereford was considered, and provisionally accepted subject to the approval of Professor J. H. W. Trail.

The Hon. Treasurer and Secretary reported that he had at that date a balance in hand of £14 0s. 0d., which was entirely due to the printing fund, and that he must still earnestly invite members to contribute liberally to the same. At the present time he had five outstanding subscriptions to come in for the current season, but they had yet to pay for the Transactions, the Programme of that Foray, and other incidental expenses for the same period, thus showing that apart from the printing fund they had no means with which to do it.

78 foundation members had now been enrolled, of which number 55 might be considered as on the active list. 5 new members—Messrs. C. P. Bird, W. H. Burrell, Cecil H. Spencer Percival, and C. T. M. Plowright and Professor F. W. Oliver—had joined the Society since the last Transactions were printed; whilst 4 members —Messrs. F. T Mott, J. Needham, S. G. N. Spofforth and Herr Dr. Professor Rehm—had resigned.

Miss Annie Lorrain Smith then read her paper on "The fungi of germinating farm seeds" (see p. 182), and Dr. C. B. Plowright a short paper on "Ozonium auricomum" (see p. 181).

On Thursday, the 26th of September, the members drove to Columb John, from whence the Killerton Woods were thoroughly investigated and the somewhat scarce *Lepiota Badhami* B. and Br. was found in considerable abundance, growing under oaks and Spanish chestnuts. On the conclusion of the day's work, their fellow-member, Sir Charles Thomas Dyke Acland, most hospitably entertained the members to tea at Killerton.

In the evening at the headquarters Mr. Barker contributed a paper entitled, "Spore formation in Saccharomycetes" (see p. 187), and Professor H. Marshall Ward one on "Recent observations on Puccinia dispersa Erikss." (see p. 179). Dr. C. B. Plowright then gave a demonstration of the 250 specimens set out for exhibition in the room. The President next drew the attention of the members to the fact that only a few numbers of the first Transactions were left for sale, and it was unanimously decided that the Hon. Secretary should be directed to part with no further copies except as a complete set with the next number of the Transactions, which would complete their first volume, and at an increased price.

A hearty vote of thanks was then accorded to the landowners who had so kindly granted to them permission to visit their estates, to Mr. E. H. Quicke and to Sir Charles Thomas Dyke Acland for their generous hospitality, to Mrs. Amy Montague for the able

arrangement of the daily forays, and to the Governors of the Royal Albert Memorial College, Exeter, for the loan of the room.

On Friday, the 27th September, some more woods adjacent to Newton Saint Cyres were searched, and *Femsjonia luteoalba* Fr. was again found, this time growing on oak. Miss A. Lorrain Smith gathered a mould new to the British Fungus Flora *Helminthosporium obclavatum* Sacc., and also specimens of the somewnat rare *Sporochisma mirabile* B. and Br. In the annexed list over 400 species are enumerated as the result of the week's foray.

Complete List of Fungi gathered during the Foray.

Amanita phalloides Fr., mappa Fr., pantherina Fr., muscaria Fr., rubescens Fr., spissa Fr., adnata W. G. Smith=junquillea Quélet.

Amanitopsis vaginata Roze.

Lepiota procera Scop., permixta Barla, rachodes Vitt. and vār puellaris Fr., excoriata Schaeff., mastoidea Fr., Badhami Berk., metulæspora B. and Br., cristata A. and S., erminea Fr., holosericea Fr., leucothites Vitt., granulosa Batsch., amianthina Scop.

Armillaria mellea Vahl., mucida Schrad.

Tricholoma sejunctum Sow., resplendens Fr., acerbum Bull., flavobrunneum Fr., albobrunneum Pers., pessundatum Fr., rutilans Schaeff., scalpturatum Fr., vaccinum Fr., terreum Schaeff., saponaceum Fr., cuneifolium Fr., virgatum Fr., carneum Bull., nudum Bull., melaleucum Pers., sordidum Fr.

Clitocybe nebularis Batsch., odora Sow., rivulosa Pers., cerrusata Fr., phyllophila Fr., candicans Pers., dealbata Sow., infundibuliformis Schaeff., geotropa Bull., flaccida Sow., fragrans Sow.

Laccaria laccata Scop.

Collybia radicata Relh., platyphylla Fr., fusipes Bull., maculata A. and S., butyracea Bull., velutipes Fr., vertiruga Cke., confluens Pers., tuberosa Bull., esculenta Wulf., acervata Fr., dryophila Bull.

Mycena pelianthina Bolton, aurantio-marginata Fr., pura Pers., luteoalba Bolton, polygramma Bull., galericulata Scop., rugosa Fr., ammoniaca Fr., alcalina Fr., filopes Bull., amicta Fr., debilis Fr., hæmatopoda Pers., sanguinolenta A. and S., galopoda Fr., leucogala Cke., epipterygia Scop., clavicularis Fr., tenerrima Berk.

Omphalia fibula Bull.

Pleurotus ostreatus Jacq.

Volvaria Taylori Berk.

Pluteus cervinus Schaeff.
Entoloma jubatum Fr., sericellum Fr., sericeum Fr., nidorosum Fr.
Clitopilus prunulus Scop., orcella Bull., carneo-albus Wither.
Leptonia lampropoda Fr., serrulata Fr., chalybea Pers., incana Fr.
Nolanea pascua Pers., mammosa Fr.
Claudopus variabilis Pers.
Pholiota terrigena Fr.=Cookei Fr., togularis Bull., spectabilis Fr., adiposa Fr., mutabilis Schaeff.
Inocybe pyriodora Pers., Bongardii Weinm., fastigiata Schaeff., rimosa Bull., asterospora Quél., eutheles B. and Br., geophylla Fr.
Hebeloma fastibile Fr., glutinosum Lindgr., mesophæum Fr., crustuliniforme Bull.
Flammula alnicola Fr.
Naucoria melinoides Fr., semiorbicularis Bull., escharoides Fr.
Galera tenera Schaeff., hypnorum Batsch.
Tubaria furfuracea Pers., crobula Fr.
Crepidotus mollis Fr.
Agaricus campestris Linn. and var silvicola Vitt., arvensis Schaeff., xanthoderma Genev., pratensis Schaeff., hæmorrhoidarius Schulz., comptulus Fr.
Stropharia æruginosa Curt., squamosa Fr., semiglobata Batsch.
Hypholoma sublateritium Schaeff., capnoides Fr., fasciculare Huds., velutinum Pers., appendiculatum Bull., hydrophilum Bull.
Psilocybe sarcocephala Fr., semilanceata Fr., fœnisecii Pers.
Psathyra corrugis Pers., fibrillosa Pers.
Anellaria separata Karst., fimiputris Karst.
Panæolus phalænarum Fr., sphinctrinus Fr., campanulatus Fr.
Psathyrella gracilis Fr., atomata Fr., disseminata Pers.
Coprinus atramentarius Fr., picaceus Fr., niveus Fr., micaceus Fr., lagopus Fr., plicatilis Fr.
Bolbitius tener Berk.
Cortinarius (Phlegmacium) triumphans Fr., largus Fr., infractus Pers., multiformis Fr., calochrous Fr., purpurascens Fr., and var subpurpurascens Fr., dibaphus Fr., prasinus Fr.
(Myxacium) collinitus Sow., mucifluus Fr., elatior Fr., delibutus Fr., pluvius Fr.
(Inoloma) violaceus Linn., alboviolaceus Fr., pholideus Fr.
(Dermocybe) caninus Fr., anomalus Fr., lepidopus Cke., cinnamomeus Fr.
(Telamonia) torvus Fr., hinnuleus Fr., hemitrichus Fr.
(Hydrocybe) subferrugineus Fr., armeniacus Fr.
Gomphidius gracilis Berk.
Paxillus involutus Fr.
Hygrophorus chrysodon Fr., virgineus Wulf., conicus Fr., calyptræformis Berk., chlorophanus Fr., psittacinus Schaeff.

Lactarius torminosus Schaeff., turpis Fr., controversus Pers., blennius Fr., circellatus Fr., uvidus Fr., pyrogalus Bull., vellereus Fr., deliciosus Fr., pallidus Fr., quietus Fr., rufus Scop., aurantiacus Fr., serifluus Fr., subdulcis Fr.

Russula integra Fr., lutea Fr., armeniaca Cke., cærulea Fr., nitida Fr., puellaris Fr., nigricans Fr., adusta Fr., furcata Fr., lepida Fr., vesca Fr., depallens Fr., cyanoxantha Schaeff., fellea Fr., drimeia Cke., ochroleuca Fr., emetica Fr., fragilis Fr.

Cantharellus cibarius Fr., Friesii Quél., aurantiacus Fr., tubæformis Fr., infundibuliformis Fr.

Nyctalis asterophora Fr., parasitica Fr.

Marasmius peronatus Fr. oreades Fr., erythropus Fr., rotula Fr., androsaceus Fr., Hudsoni Pers., epiphyllus Fr.

Lentinus cochleatus Fr.

Panus stipticus Fr.

Lenzites betulina Fr.

Boletus luteus Linn., elegans Schum., flavus Wither., granulatus Linn., tenuipes Cke., badius Fr., piperatus Bull., chrysenteron Fr., subtomentosus Linn., radicans Pers., edulis Bull., crassus Mass., luridus Schaeff, laricinus Berk., scaber Fr.

Fistulina hepatica Fr.

Merulius lachrymans Fr., corium Fr.

Dædalea quercina Fr.

Poria vaporaria Fr., medulla-panis Fr., blepharistoma B. and Br., sanguinolenta A. and S.

Polystictus perennis Fr., versicolor Fr., radiatus Fr. abietinus Fr.

Fomes ulmarius Fr., annosus Fr., applanatus Walhr.

Polyporus Schweinizii Fr., rufescens Fr., squamosus Fr., giganteus Fr., sulphureus Fr., dryadeus Fr., hispidus Fr., betulinus Fr., adustus Fr., fibula Fr.

Hydnum repandum Linn. and vär rufescens Pers., zonatum Batsch., auriscalpium Linn., farinaceum Pers., udum Fr.

Irpex obliquus Fr.

Radulum fagineum Fr.

Phlebia merismoides Fr.

Grandinia granulosa Fr.

Craterellus cornucopioides Pers., sinuosus Fr.

Thelephora caryophyllea Pers., laciniata Pers.

Stereum ochroleucum Fr., purpureum Pers., hirsutum Fr., rugosum Fr., sanguinolentum A. and S.

Auricularia mesenterica Fr.

Corticium giganteum Fr., calceum Fr., quercinum Fr., incarnatum Fr., comedens Fr.

Sparassis crispa Fr.

Clavaria fastigiata Linn., muscoides Linn., cinerea Bull., cristata Pers., rugosa Bull., flaccida Fr., inæqualis Fl. Dan., vermiculata Scop., fragilis Holmsk., pistillaris Linn.
Calocera viscosa Fr., cornea Fr., stricta Fr.
Tremella mesenterica Retz., albida Huds., lutescens Pers.
Hirneola auricula-Judæ Berk.
Femsjonia luteoalba Fr.
Dachryomyces deliquescens Dub., stillatus Nees.
Hymenogaster tener Berk.
Scleroderma vulgare Fr., verrucosum Pers.
Crucibulum vulgare Tul.
Cyathus striatus Hoffm.
Lycoperdon excipuliforme Scop., saccatum Vahl., gemmatum Batsch., pyriforme Schaeff., perlatum Pers., cælatum Bull., bovista Linn., plumbeum Pers., nigrescens Vitt.
Ithyphallus impudicus Fisch.
Mutinus caninus Fr.
Ceratiomyxa mucida Schroet.
Craterium pedunculatum Trentepohl.
Stemonitis fusca Roth.
Trichia fallax Pers.
Arcyria punicea Pers., incarnata Pers.
Lycogala miniatum Pers.
Cylindrium flavo-virens Bon.
Aspergillus glaucus Link.
Penicillium glaucum Link.
Sepedonium chrysospermum Fr.
Asterophora agaricicola Corda.
Rhinotrichum ramosissimum B. and C.
Sporotrichum chlorinum Link.
Hormiscium hysterioides Sacc.
Zygodesmus fuscus Corda.
Helminthosporium fusiforme Corda., obclavatum Sacc.
Acrothecium tenebrosum Sacc., obovatum Cke.
Sporochisma mirabile B. and Br.
Isaria farinosa Fr.
Tubercularia vulgaris Tode.
Puccinia lychnidearum Link., obscura Schröt. (the aecidious condition)
Phragmidium rubi Pers.
Uredo Mülleri Schröt. (the uredo condition of Phragmidium albidum (Kuhn.)
Cronartium ribicolum Dietr.
Nemaspora crocea Pers.
Spinellus fusiger Van Tiegh.
Sphærotheca pannosa Wallr.
Uncinula adunca Lév.

Erysiphe Montagnei Lév.
Eurotium herbariorum Link.
Rhytisma acerinum Fr.
Bulgaria polymorpha Wettstein.
Coryne sarcoides Tul.
Mollisia cinerea Karst.
Helotium citrinum Fr., virgultorum Karst.
Belonidium pruinosum Mass.
Ciboria echinophila Sacc., ochroleuca Mass. = firma Pers.
Chlorosplenium æruginosum De Not.
Tapezia cæsia Fckl.
Dasyscypha virginea Fckl., calycina Fckl.
Peziza vesiculosa Bull.
Otidea aurantia Mass.
Helvella lacunosa Afzel.
Leotia lubrica Pers.
Epichloe typhina Berk.
Hypomyces aurantius Tul.
Nectria cinnabarina Fr., ditissima Tul.
Xylaria hypoxylon Grev.
Ustulina vulgaris Tul.
Daldinia concentrica Sacc.
Quaternaria Persoonii Tul.
Chætosphæria phæostroma Fuckl.
Trichosphæria pilosa Fuckl.

ADDRESS BY THE PRESIDENT.

Professor H. MARSHALL WARD, D.Sc., F.R.S., F.L.S., F.R.H.S., Cambridge.

Ladies and Gentlemen,

During this, my second year of tenure of the office you have done me the honour to confer on me, suggestions have been made to the effect that some account of the methods used in botanical laboratories for the study of Fungi would be at least acceptable to amateurs, and very useful to those who concern themselves more closely with mycology .

Personally, I am of the opinion that a man must make his methods as he proceeds, and that it very rarely happens that mere descriptions of the technique of others help one much ; but although this is true of details, it would be absurd to refuse to admit that we can all learn something from each other in regard to general processes, and I need hardly say it will give me the greatest pleasure to comply with the request that I should put into a few words some descriptions of the methods employed in my own and similar laboratories, and that if anything said by me to-night should be really of use to any of you, it will add keen satisfaction to the pleasure.

It is obvious that in the time at our disposal my remarks can amount to nothing beyond a bare outline of an immense subject, but, as I understand it, that is what is required—a sketch of the technique of modern mycology.

Methods of killing, fixing, hardening and preserving Fungi are now numerous. Few fungi can be satisfactorily observed on mere drying, except superficially and for the comparative purpose of the systematist. For Herbarium purposes it is usual to dry the specimens by pressing them between paper, as with higher plants, and this is quite satisfactory in the case of most epiphytes or parasites on leaves, twigs, paper, &c., where the substratum can be employed, or in the case of the harder Polyporei, *Corticium*, &c.

In the case of the larger fleshy Hymenomycetes much can be done by the well known spore-maps obtained by allowing the

spores to fall gently on to paper placed beneath the gills &c., and fixing them with collodion; and by means of carefully dried sections, and I have seen very satisfactory preparations dried in sand and kept in boxes.

Nevertheless both in the case of the larger fleshy fungi, and in that of the delicate mould fungi—e.g., Mucedines and Hyphomycetes—no preparations equal those kept in properly stoppered bottles of preservative fluids, and when it comes to gelatinous and aquatic fungi I know of no other way of keeping them at all, if they are to be examined afterwards.

At the outset it has to be admitted that no fluid preserves the delightful colours in all their beauty, and drawings are absolutely necessary as adjuncts to any complete collection. Some success is claimed, however, for recent attempts with various fluids.*

Of the fluids employed absolute alcohol is no doubt the most satisfactory and simplest, and it becomes diluted by the water it abstracts from the larger forms sufficiently to counteract the disadvantageous brittleness brought about in smaller species.

But it must be remembered that alcohol in all its forms induces changes which render objects preserved in it useless for any but comparatively rough and superficial observation later. Moreover, absolute alcohol is expensive, and the various cheaper forms of alcohol, methylated spirit, &c., cause contractions and distortions, and entail other drawbacks in even greater degrees.

Formalin is excellent for many purposes of preserving, but its keeping powers are limited, and although it often preserves colours for many months, it softens and injures the tissues.

Much can be done in special cases with glycerine, carbolized media, and even gelatine, but none of these media afford really permanent preparations which can be examined after the course of months or years with results much better than those obtainable in properly dried specimens.

The primary causes of failure in all the foregoing cases are two—(1) The contractions caused by the sudden or unequal extraction of the water of organisation and of the cell-sap; and (2) chemical and physical changes in the soluble cell-contents and protoplasm, involving not only loss of colour but many more subtle alterations.

There are, however, two methods of so preserving fungi that even after the lapse of years all but the most refined details can be made out, and which may be specially recommended to the notice of collectors. Both are available for the purposes of the traveller and museum curator, as well as for those of the laboratory worker, and I would strongly urge their adoption by collectors who wish to have their material properly preserved for subse-

* See Lutz, Bull. Soc. Mycol. de Fr., T. xvii., 1901, p. 302.

quent examination. One of these methods is extremely easy and quick in its action, and although the penetration into larger fungi may have to be facilitated by puncturing, slashing, or cutting the specimen if it is intended for histological examination, I have obtained excellent results with it for museum purposes by merely plunging a *Boletus* or Agaric into the medium as a whole.

The hardening and fixing fluid is prepared by adding a few drops of concentrated acetic acid to a solution of corrosive sublimate in water, and allowing the specimen to soak in this for 24 hours or more, after which it may be bottled in alcohol without more ado.* The corrosive sublimate—mercuric chloride, $HgCl_2$—is, I need hardly remind you, a dangerous poison, but it has the advantage of being easily carried in crystals and made up as required.

Small fleshy fungi, such as species of *Mycena*, *Coprinus*, *Leotia*, &c., and gelatinous forms, such as *Exidia*, *Auricularia*, &c., as well as delicate moulds like *Mucor*, *Pilobolus* or parasites like *Saprolegnia*, *Peronospora*, *Cystopus*, &c., can be beautifully fixed and preserved by this means.

If you want the best attainable results, however, in the way of perfect fixation and hardening for histological purposes, I would recommend the following much more troublesome method, the principal drawbacks to which are, that it is extremely difficult to carry out the very thorough washing process (absolutely necessary for success) when travelling or away from the laboratory, and that the solutions and alcohols are so much more complex.

The specimens—whole or in pieces according to their size and consistency—are plunged fresh into weak Flemming's solution for 12-24 hours or even longer. They are then washed in running water for at least the same period, until every trace of the fixing fluid is removed, and then transferred to the following in succession, in each of which the specimens should remain for 12-24 hours—viz., 30 per cent., 50 per cent., 70 per cent., and 90 per cent. alcohol. Here they may remain for transmission or for further treatment to be referred to subsequently.

For some purposes it will be regarded as a disadvantage that the osmic acid in the Flemming's solution† stains the objects black,

* A good formula is that of Keiser's solution—
$HgCl_2$ = 5 grams.
Water = 300 c.c.
Acetic Acid = 3 grams. [See, for instance, Strasburger *Das Botanische Practicum*, 3rd ed., p. 50.]

†A suitable solution is :—

Chromic Acid	0·25	per cent.
Osmic Acid	0·1	,,
Acetic Acid	0·1	,,
Water	99·73	,,

(See Strasburger l. c. or any of the histological manuals.)

but this can be removed at any time by means of hydrogen peroxide. I have frequently prepared museum specimens of fleshy or even gelatinous fungi by these means, so that they remain permanently as firm as india-rubber and without contraction, and although they gradually deteriorate for histological purposes afterwards—*e.g.*, as regards staining properties, &c., if kept long in alcohol, and especially if kept in absolute alcohol—even this can be got over to some extent by keeping them in a mixture of alcohol, glycerine, and water.

These are by no means the only methods which have been devised for hardening, fixing and preserving fungi, but I have selected them as two of the best known to me for general purposes, and of wide application to practically all the forms the collector is likely to wish to put up in bottles.

I now pass to consider methods of histological examination—*i.e.*, the investigation by means of the microscope of the finer structure of the fungi.

We need not dwell on the ordinary cases of direct inspection of the collected fungus by means of the pocket-lens or microscope, except that I wish to emphasize my own conviction that just as much valuable work has been done in the past by means of the lens and accurate descriptions of the forms gathered together and examined at once in the fresh state, so much still remains to be done, and certainly some of the finest training possible in out-door natural history is obtainable by the cultivation of these habits of direct observation in the field. Moreover, as we shall see when we come to study culture-methods, direct observation of the living fungus yields results unattainable by any manipulation of dead forms, however well preserved and prepared.

When all is said and done, however, there remain numerous problems only to be solved by the examination of prepared material—*e.g.*, questions concerning the nature of the cell-wall and contents, nuclei, spore-formation, sexual organs, and so forth—and with some of the more minute fungi their very existence is hardly demonstrable in the fresh condition. The same applies especially to many parasites in vegetable and animal tissues, and it is marvellous what striking results can be obtained with properly prepared sections, as compared with the rough glimpses at the general state of affairs, with which our ancestors had to be content.

I know, moreover, that I am expected to say something as regards methods both of staining and of section-cutting, and thus to enter on dangerous ground for the amateur; and at the outset you must allow me to express my firm conviction that more time can be wasted in this branch of work, and more trifling results

obtained, than in any other domain of science that has had the misfortune to become the hobby of the dilettante, not even excepting the collecting of dried plants. Personally, I am strongly in favour of eliminating all but one or two well tried methods of staining capable of very general application, and in the present instance shall confine myself to two only, which I have myself found to be extremely valuable.

There are several methods of hardening and staining the more delicate fungi for the purpose of permanent microscopical preparation, of which we may select the following as one which has been found generally useful.

Suppose we have a satisfactory growth of such a form as a *Saprolegnia*, growing on a fly floating in water, or of a *Mucor* developed on a piece of fruit, bread, &c. In such cases the whole mass may be thrown into the weak Flemming's solution and be killed, fixed, and hardened in one operation, the washing and passage through the alcohol being very thoroughly and carefully accomplished as before.

The material having reached the last stage of hardening, in absolute alcohol, is then placed bodily into a dilute solution of iron-alum, and left there for several hours until thoroughly penetrated by this re-agent.

This done, the fungus is transferred to water for a few seconds, to remove the adhering excess of alum, and then cast into a very dilute staining fluid made up in various ways, of which the following extremely simple one is perhaps as good as any:—5 grams of Haematoxylin dissolved in a litre of distilled water. Almost any desired depth of staining can be obtained by this solution, if attention is paid to the thorough washing out of the iron-alum, bleaching by means of hydrogen peroxide if necessary, or partially decolourising by re-immersion in iron-alum, and so on.*

The properly stained fungus is now passed again gradually through the alcohols, to prevent contraction when transferred finally to xylol and Canada balsam, or to glycerine and glycerine jelly for final mounting.

Let us now suppose that we have to deal with large fungi, or with parasitic forms, such as *Puccinia*, *Æcidium*, &c., in leaves or other parts, which are too opaque and bulky to mount whole, and which must be examined by means of sections.

Again there are various methods which may be employed or modified in different cases, and again we will select one which I know from extensive practical experience to be generally useful.

*For further details as to these processes the reader is referred to handbooks on histology, such as those already cited, or Chamberlain *Methods in Plant Histology*, Chicago, 1901.

The material having been properly hardened in Flemming's solution, and then in the graduated alcohols, is placed in absolute alcohol for 24 hours, then in a mixture of absolute alcohol and chloroform until it sinks, and from this is transferred successively to pure chloroform, to a mixture of chloroform and paraffin kept at a uniform temperature of about 58° C. and finally to pure paraffin wax with a melting point of 58°. Here it remains until the melted paraffin has penetrated every part of the hardened mass, which may take several days.

The melted matrix with its embedded piece of material is now poured into a small cuboidal mould, and allowed to set, care being taken to orientate the fungus so that we know the direction of its various axes, and with certain precautions the whole is cooled in water, and turned out of the mould as a solid block, hard enough to hold the material fixed, but sufficiently soft to allow a sharp razor to pass bodily through fungus and wax together.

This block, again properly orientated, is now affixed to a holder so arranged that the razor shaves off slice after slice, and the thin sections are secured as they come off and arranged for mounting.

I am not here concerned with mechanical details devised to ensure definite thickness of sections, their sequence, in ribbons or otherwise, &c., and pass on to consider the further fate of the sections themselves.

Each section is a clean cut slice of wax, firm enough to hold the embedded finely cut fungus in place, and if we lay the whole in some reagent which dissolves the wax, we have only the finely cut piece of fungus left, which will probably tumble to pieces or crumple up owing to the loss of its supporting wax matrix.

To avoid this the sections are arranged on a glass slide on a thin film of white of egg, and allowed to remain there till the latter dries and glues them in place by means of its adherence to the clean cut walls.

Now we can dissolve out the paraffin wax and have our fungus sections fixed *in situ* for further examination.

Following the procedure of the method here chosen, this is done as follows:—The slide with its adherent sections is placed in xylol, which rapidly dissolves the paraffin wax, but has no solvent action on the transparent film of egg-white cementing the sections to the glass. From the xylol the slides are transferred to absolute alcohol, and after this has replaced the last trace of xylol the sections are ready for staining.

The staining may be done as before, by first soaking the sections in iron-alum, and then, after washing in water, transferring them to dilute Haematoxylin, passing through the

alcohols, to xylol, and finally mounting in Canada balsam. Or, and here I am about to describe the second of the two methods promised above, the following much more complex procedure may be adopted when certain finer histological details concerning the protoplasm and nuclei are in question.

The slides with their adherent sections are removed from the alcohol to a solution of the intense red dye Safranin, and left in this for several hours. When deeply stained, they are rapidly rinsed in water, and if necessary in alcohol to remove excess of the dye, and then plunged into a dilute watery solution of gentian violet, and again left for some minutes to an hour or more, until they appear deep blue-purple. After another quick washing, to remove excess of adherent dye, they are put for a few minutes into a bath of a 1 per cent. solution of a dye known as Orange G., which exerts some peculiar action facilitating the removal of the excess of the violet without at the same time washing out the Safranin. The preparations are then finished in absolute alcohol, transferred to clove-oil, and finally mounted in balsam.

It is impossible here to go into all the small points which have to be attended to in obtaining the proper intensity of staining, dehydration, &c., in this admittedly complex method,* but the results in a successful preparation where the more solid parts of the nuclei are brilliant red, other granules violet, and the nuclei and chlorophyll-granules of the host-plant picked out in equally sharp colours, are worth the trouble in certain cases.

I now leave the subject of methods of investigating the dead structures, and proceed to the consideration of methods of culture and examination of the living fungus; methods which are, in my opinion, of more importance in the present state of science, and destined to teach us far more of the nature of these extraordinary organisms. It is obvious at the outset that our methods must differ according to the kind of fungus we are going to cultivate; not only will saprophytes behave very differently from parasities, but each group presents its own problems in cultivation, and many of these problems are as yet unsolved.

Commencing with saprophytes, as the easier to deal with in practice, I distinguish between methods of isolation and methods of culture proper. Suppose, for instance, that we have gathered a species of *Mucor*, *Sporodinia*, *Phycomyces*, *Rhizopus*, or other easily grown Mucorine, the probability of our obtaining a pure culture by direct sowing of the spores on any medium is almost infinitely remote. Indeed it is sheer waste of time to attempt it in most cases, since the following simple method of isolating the fungus from its contaminating bacteria, moulds, &c., can be so readily employed.

* See, for further details, Zimmerman, Hoff, *Botanisches Centralblatt*, 1898, vol. 76, p. 66.

I take a tube of sterile water, and shake up the spores of the *Mucor* thoroughly in it, thus distributing the spores of the fungus, and any impurities present, far apart in the liquid.

I then take a sterile tube of gelatine, rendered nutritious by the addition of some vegetable extract and melted by placing the tube in water at 25° C., and transfer a few drops of the above emulsion of mixed spores to the liquid gelatine medium. A sharp shake up separates spores and impurities even further apart than before, and now the contents of the tube are poured on to a perfectly sterile glass plate, on which the gelatine rapidly flows in a thin film and sets to a firm clear jelly. In this jelly there will now be imbedded, at various distances apart, the spores of the *Mucor* and those of the foreign contaminants from which separation is desired. In a few hours—it may be 12, 24, or 48 or more—each isolated spore will begin to germinate in its fixed position if the conditions suit it, and since we can observe this under a microscope it is not difficult to pick out the young mycelium as it develops with a sterile needle and transfer it bodily to a new sterile tube of the culture medium.

If the original sowing of contaminated material contained many spores, however, it may be that this first "isolation plate" will still be far too crowded to allow of our picking up only one mycelium, therefore I almost invariably proceed as follows:—

Having shaken the spore material in the distilled water, I have ready 6 gelatine tubes, which we may call A, B, C, &c., standing in water at 25° C., and 6 plates to be labelled *a*, *b*, *c*, &c. I then make the first plate (*a*) as already described, but take care to pour into it only about 9-10ths of the spore-laden gelatine of the tube A.

The tube A is then filled up with the spore-free gelatine of tube B, thus distributing—by shaking—its remaining 1-10th of spore-laden gelatine into the newly added gelatine, and again 9-10ths of this are poured into a second plate (*b*), where it runs and sets as before. Now it is evident that the plate *b* will only contain about 1-10th as many spores altogether as does the plate *a*, and since these are distributed over an equal area they are more widely separated one from another. I then take a third tube of spore-free gelatine and add its contents to the tube A, in which 1-10th of the spore-laden gelatine remains—*i.e.*, about 1-100th of the original spores—and repeat the process, and so on to the fourth, fifth, and sixth.

Obviously, then, each successive plate will contain theoretically 1-10th of the number of spores previously sown: so that if plate *a* has 10,000 spores, *b* will have 1000, *c* only 100, and *d* only 10, the fifth (*e*) only 1, and the sixth plate (*f*) none. And in practice it is found that a properly made series of plates has fewer and

fewer spores, more and more isolated after each dilution, in proportions sufficiently like this to make the illustration applicable.* Of course, experienced hands and eyes soon learn to appreciate the relative sizes and numbers of the spores and impurities to be dealt with in the first instance. If one has a good, clean growth of the *Mucor* to begin with, with up-standing sporangia yielding plenty of clean spores to a touch of a moist needle point, hardly any trouble will be met with, and the second or third plate will probably yield perfectly pure and well isolated mycelia; but if the original spore material is derived from a rotting fruit, or macerated tissues, for instance, there may be far more bacteria, infusoria, and moulds, &c., than *Mucor* spores, and it may result that even the sixth plate was not sufficiently dilute, and other series have to be made with the partially purified material, until perfect isolation is at last assured.

Troublesome and tedious though this method may at first sight appear, I have found that it is the shortest in the end wherever it is seen at the outset that the fungus desired will grow on such a medium as the gelatine referred to. This is by no means always the case, however, and even such substitutes for gelatine as agar, apple-jelly, quince-mucilage, &c.—all of which I have used with more or less success in special cases, as well as the curious mineral silica jelly, so difficult to prepare and use successfully—fail with many fungi. It would take us too far to discuss the special methods which may be employed for isolation in such cases, as well as to enumerate the many fungi which have hitherto resisted all attempts of the kind.

It may surprise some of you to learn that *Saprolegnia*—its name refers to its habitat in putrid substances, swarming with bacteria and infusion—can be isolated and grown in pure culture on artificially prepared media, yet such is the fact. If we place a small tuft of actively growing *Saprolegnia* at a time when the zoosporangia are just emitting their zoospores, in water sterilised by a Pasteur filter and in which a few sterilised flies have been cast, a few hours suffice for infection and the development of nearly bacteria-free growths from which re-infection on sterilised flies' legs can easily be got.

On placing such a preparation on the sloped surface of gelatine prepared with extract of meat—of course properly sterilised—the fungus rapidly grows out in a radiating fringe round the fly's leg, and from the outer edges of this halo-like fringe pieces can be obtained almost devoid of bacteria. Such a piece, transferred to another tube, gives a still cleaner culture, and by repeated transferences to new tubes, pure cultures are at length obtained. Or boiled peas can be employed instead of the gelatine, as Klebs has shown.

* The method is a particular modification of a procedure known generally in all bacteriological and botanical laboratories.

Such pure growths are quite infertile, however, and remain so for months or years, though we can obtain zoospores or oospores at any time in a few hours by transferring a piece to water or food materials in water. It is interesting to note that Trow* has recently applied a similar method for obtaining pure cultures of a *Pythium*, modifying the procedure in so far that he obtains his material from the ærial hyphæ developed from the surface of the solid material.

Having isolated our fungus, the next step is to cultivate it as a pure growth, and here we may aim at either one of two objectives: we may (1) wish merely to grow the fungus successfully in masses and observe its behaviour, much as a gardener desires to see the effect of a bed of annuals which he sows thickly, or (2) we may want to trace the details of germination and development of a single spore and plant under the microscope, much as a physiologist focusses his attention on a single plant grown from seed in a pot.

In illustration of the first case; among the more troublesome forms which can, nevertheless, be cultivated, may be mentioned the various wood-destroying Hymenomycetes—*e.g.*, species of *Stereum*, *Collybia*, *Armillaria*, &c. The principal difficulty in these cases is to obtain the isolated specimen to start with, but having obtained that its further growth is ensured by transferring it to a block of wood—due regard being had to the species it was found growing on—resting on a little moist cotton wool in a plugged tube, and thoroughly sterilised by heating in a steamer.

It by no means follows that you will bring such cultures to a successful issue, however, and I may take this opportunity of saying that the cultures of *Marasmius androsaceus* referred to in my last address† have not even yet, after two years culture, developed any trace of pileus. They are still alive, and apparently growing, but they yield no fructification. In the choice of food-materials, attention should be paid to what is known of the habits of the fungus. Most saprophytic fungi will endure, or even prefer, an acid medium, and in many cases this helps us to subdue intermixtures of bacteria on the isolation plates; but some—*e.g.*, *Saprolegnia*—are easily killed if the medium becomes acid. Again, it is a rule that fungi growing on dung or other animal débris succeed better on gelatine media with extracts of dung, &c., than do saprophytes normally met with on decaying fruit, roots, or other vegetable tissues. Indeed, I sometimes find that gelatine—an animal substance—acts like a

* Ann. of Bot., 1901, vol. xv., p. 269.

† pp. 139-40.

poison to such forms as will grow freely on sterilised slices of potato, carrot, banana, beet, artichoke, or on agar—a vegetable product—mingled with decoctions of plums, grapes, oranges, &c., or with beer-wort.

Passing now to the second case, just referred to, perhaps the most difficult of all processes, though it is at the same time one of the most valuable and interesting, is that of the isolation and germination of spores in hanging drops under the microscope. The end to be attained can be reached in various ways. Here will be described only the method I generally employ, using for illustration a spore of *Botrytis*, or any other which is large enough to be readily seen with a good hand-lens, because I want to describe how the ideal hanging-drop culture—where the drop contains only a single spore—may be prepared.

Having obtained a pure culture of *Botrytis* by separation on plates, and transferred it to a tube of some medium on which it readily grows and forms conidia—*e.g.*, wort-agar—we have in a few days abundant crops of the grey-brown spores.

A sterile platinum wire easily removes hundreds of such spores if passed through the crop, and these are shaken up in a tube of gelatine medium—*e.g.*, wort-gelatine—and thus disseminated through the mass as in the preparation of separation plates. On now dipping the point of a needle into the spore-laden gelatine, and touching a coverslip with it, a drop is obtained, and a glance with the microscope—or, in this case, even a good hand-lens—at once tells us whether the drop has brought with it one or more spores or not. If each of several trials yields no spore, the sowing in the tube was too small, and more spores should be added: if the sample drops contain many spores, more gelatine is to be added to the tube, until the average drop brings out only a few—say 1 to 10—spores. This object achieved, we may then proceed as follows:—

A number of glass culture-cells are to hand, already plugged and sterilised in large tubes holding three or four each. One of these is laid on a glass slide, hot from the Bunsen flame, and cemented to the slide by placing a bit of paraffin of M.P. 60° C. at the edge, where it melts and runs in, and solidifies as the slide cools, cementing the cell to the latter.

Meanwhile a number of thin cover-slips are placed between plates of talc, and sterilised by the Bunsen flames, and allowed to cool. Then sterile water is placed in each arm of the culture-cell, and the apparatus is ready.

Taking one of the sterile cover-slips held by forceps at one corner, a minute drop of gelatine from the spore-laden tube is placed in its centre, and the cover-slip rapidly inverted and laid on the culture-cell, to which it now forms the roof, the gelatine drop pendent from its lower side—a "hanging drop."

The microscope shows at a glance whether our drop contains a spore, or several, or none; in the latter case we repeat the drop-making process until a drop is obtained which contains *one* spore only. This result achieved the cover-slip is held in place by running in melted vaseline and wax, or any other suitable cement, and the culture is ready.

The drop is now placed under a microscope in such a position that the one spore is in focus: a careful drawing is then made, the time and temperature, as well as the distinguishing mark of the culture noted, and each stage of the germination, &c., observed as necessary.

It is, of course, in the study of the true parasitic fungi that the greatest difficulty in obtaining pure cultures must be expected, and in most cases no attempt has been made to overcome the apparently insuperable obstacles which obtrude themselves. For, let us see what a pure culture of a true parasite involves. As, before, we have to ensure a pure sowing of the spores of the fungus, and since such spores are in the ordinary course of events obtained from the host-plant, growing in the open and exposed to all kinds of wind-borne intruders, it is obvious that no such pure sowing is usually possible.

In the second place, we have to ensure a pure culture of the host-plant, and since this is commonly employed in the form of a seedling or pot-plant, growing in ordinary soil in a green-house or even in the open, no question of freedom from accidental infections or impurities can be entertained.

And, in the third and last place, we must put the conditions of the infected plant itself after inoculation. However carefully we cover up the specimen—even if as in some recent experiments by Eriksson, Klebahn and others, we place tubes or glass cases guarded with cotton-wool over them—we have no guarantee of purity of culture of either host or parasite.

Of course, in such infection experiments we rely on the following two principal factors in the results—(1) That infection occurs at a definite spot which we have marked beforehand as that where the sowing of spores was made on inoculation; and (2) that numerous repetitions of the infection—or attempts at such—yield consistent results, positive or negative as the case may be.

There arise questions, however, which make it highly desirable that pure cultures of both host and parasite should be obtained if possible, and I have recently been so fortunate as to carry into effect pure cultures of this kind even in the case of such exquisite parasites as the Uredineæ.

It is quite possible, as I have shown, to sterilise the "seeds" of grasses and germinate them in large glass-tubes on a plug of cotton-wool saturated with a suitable mineral solution, the orifice

of the tube being rendered germ-tight by a cotton-wool filter. The whole apparatus is, of course, previously sterilised by heat, and is so arranged that air may either be allowed merely to diffuse slowly in and out of the tube through the cotton-wool filter, or a supply of moist air, deprived of germs, be slowly and steadily drawn through the whole apparatus by means of an aspirator.

The "seed" soon germinates, and if the tube is properly exposed to suitable light, temperature, &c., the resulting seedling —a pure culture of the host-plant—will go on growing and unfolding new leaves for several weeks. Now I have recently succeeded in showing that if such a seedling is infected with a Uredine, normally parasitic on it, spore pustules of the latter result in due course, and if some of these spores be carefully removed from such a pustule and transferred to a second pure seedling of the grass, we have a pure culture of both host and parasite. For, although in the first infection a foreign spore or two may have been conveyed to the seedling, because we have at the outset to take our spores from an infected plant in the open, it is extremely unlikely that any contamination occurs in the second transference. At any rate, it is found in practice that very valuable results bearing on certain vexed questions of infection can be attacked by this method from new points of view.

As will readily be seen the method can also be employed with seedlings of Cress, Beech, Capsella, as well as various grasses and other plants, and infections of *Pythium*, *Phytophthora*, *Cystopus*, various Ustilagineæ and so forth, and I do not despair of extending it even to cases of perennial plants and to other parasitic fungi.

Here, however, it is time to bring to an end this sketch, and I have only to say in conclusion that it is in the application of the method and not in the apparatus that success lies. Methods are means, not ends, and to further point the moral we might travesty an old saying and declare that—It is men and not methods that are wanted.

The following communication is taken from the Annals of Botany, Vol. xv., No. lix., Sept., 1901.

THE BROMES AND THEIR RUST-FUNGUS (*Puccinia dispersa*).—I have for some time been occupied with an investigation which has involved a comparative examination of the "seeds" and seedlings of all the species and varieties of the genus *Bromus* that I could obtain, and a study of the conditions of infection of these grasses by the Uredo-form of *Puccinia dispersa*, the Rust-fungus so common on certain species of them.

The details of the results will, I hope, appear in due course, but some points of interest may be summarized now.

The uredo-spores germinate at all temperatures between about 10-12° C. and 25-27.5° C., which may be considered the minimum and maximum cardinal points; the optimum is about 18-20° C., and many failures in infection were found to be due to the fact that the leaves of the grass may be at temperatures above the maximum. Uredo-spores in water frozen for ten minutes into solid ice germinated on thawing, but freezing for two hours seems to kill them.

Infection experiments show that spores originating on a given species—*e.g.*, *B. mollis*—easily infect that species, but not necessarily another species, even if closely allied, and indeed may not infect all varieties of that species. Thus spores from *B. sterilis* easily infect *B. sterilis* and the closely allied *B. madritensis*, but not *B. mollis* or its allies *B. secalinus*, *B. arvensis*, &c., and not even the more closely allied *B. maximus*. Broadly speaking, the uredo-spores, growing on a species belonging to the *Serrafalcus* group, infect other members of that group—in varying degree, however, and not necessarily all—but fail to induce the development of pustules on species belonging to another group—*e.g.*, *Stenobromus* or *Festucoides*.

There is evidence, however, going to show that an occasional adaptation to another species may occur in cases where infection does not usually succeed. In such cases, the Uredo having once established itself on another species, its uredo-spore progeny will thenceforth readily infect that species.

The rule seems to be that the uredo-spores infect most easily the species and variety on which they have been developed, less easily varieties or species more remote, and fail altogether to gain a hold on more distant ones.

This does not appear to be a matter depending merely on the

structure of the leaves of the host plant, or on any recognizable excretion from them; at any rate the microscope shows none such, and experiments with *B. mollis* and *B. sterilis* demonstrated that the germ tubes grow readily in filtered extracts, boiled or unboiled, of the leaves. The matter evidently depends on the influence of the previous nutrition of the Fungus, as well as on the reactions of the species attacked, and presents problems of great complexity.

It is possible to grow pure cultures of the grass as well as of the Fungus for weeks and even months in closed and in ærated tubes. "Seeds," sterilised by various reagents, have been germinated in large tubes, on cotton-wool supplied with pure nutritive materials, and excellent plants thus raised out of contact with any but filtered air. Such pure cultures have been infected with uredo-spores, and the progeny utilized for similar re-infections, thus ensuring pure cultures of both host and parasite.

"Seeds," from infected plants, thus treated do not give rise to infected plants; and unless spores are sown on the leaves of the latter no pustules are developed. Moreover, pustules only arise in these cases on the spots where the spores were sown, and within the usual incubation period. These facts seem to militate against any theory of internal or intra-seminal sources of disease. It is hoped that by longer series of such pure cultures more definite information on several obscure points will be obtained.

At present the evidence points to the following conclusions. The acts of infection and incubation occupy about ten days, and many exigencies may prevent the germination of the spores, the entry of the germ-tubes into the stomata or the successful growth of the mycelium in the tissues.

Experiments go to show that the lack of certain minerals—*e.g.*, potassium or phosphates—cause a starvation of the Fungus; partial etiolation of the host, or any other hindrance to free nutrition, assimilation, transpiration, &c., also act detrimentally to the well-being of the mycelium.

Every degree of virulence of attack seems to be shown by the spores in the behaviour of their germ-tubes, either on different varieties or species of host, or on the same host in different conditions.

It appears that in certain cases the germ-tubes may kill the tissues, and cause them to turn black and shrivel up as if corroded. In such cases the parasite can make no further progress, and infection fails: In other cases a mycelium is developed, but lies dormant and produces no spores; we may compare the Fungus in this case to a plant in poor soil, or suffering from drought, &c.

Seedlings with "spears" only a millimetre or two high can be infected by applying spores to the "dew-drops" issuing from the water-stomata at the apex of the first leaf.

H. MARSHALL WARD.

CAMBRIDGE,
July 27, 1901.

OZONIUM AURICOMUM LINK.

By Charles B. Plowright, M.D.

This curious mycelial condition is familiar to all of us. Often to be found on chips in wood yards or between the bark and the wood of dead trunks, one seldom has the chance of seeing to what fungus it really belongs. Just as the familiar *Rhizomorpha* was for long recognised as a mycelial condition before its connection with *Agaricus melleus* was demonstrated, so there is a considerable amount of uncertainty about the true relationship of *Ozonium*. It is by no means impossible that all the *Ozonium*-like bodies one meets with are not connected with the same fungus. As is the case with *Rhizomorpha* the hyphæ of *Ozonium* are rather a condition of some fungal mycelium than the true vegetative mycelium, a condition in which the hyphæ are compacted into a sort of half felt half sclerotium. It is only under very favourable circumstances that one can observe the sporophore connected with them *in situ*. Having recently had the opportunity of observing the growth of a large mass of *Ozonium* and the development of sporophores connected with it a short account may not be uninteresting.

In a large earthen vase, some two feet in height, which was standing in the entrance hall of my house in King's Lynn, a flower pot containing a plant of Aspidistra was placed. Now, the vase was far too deep for the flower pot, so that the latter had to be raised from the bottom of the vase by placing it upon a block of wood, some six inches deep, as well as half an ordinary building brick. During the summer the Aspidistra was watered very freely, so that a considerable amount of water ran through the flower pot and collected in the bottom of the vase. It remains only to be added that the mouth of the vase was narrower than its body, so that the space between it and the top of the flower pot was only a narrow chink, and even this

was filled up for ornamental purposes by a frill of coloured paper.

In the months of September and October a succession of *Coprini* came up in the flower pot amongst the roots and between the stems of the Aspidistra. At first these attracted little notice, but after a time they were more carefully examined and proved to be *C. domesticus* Fr. Further investigation led to the flower pot being lifted out of the vase. It was found to be covered with the yellow hyphæ of *Ozonium*, as well as the brick and block of wood upon which it stood. The hyphæ were seen entering the opening at the bottom of the flower pot and the larger openings in the bottom and sides of the porous earthenware of which it was formed. These hyphæ had grown up through the mould until they reached the light and produced their sporophores on the surface as before described. The association of *Ozonium* with *Coprinus* had been observed in the spring of the same year. In West Briggs Wood, Wormegay, a decaying stick was found with a *Coprinus* on its upper side and a mass of *Ozonium* on its lower. No very careful examination was made at the time, so the species was not noted, and it may have been *C. domesticus*, but it is more likely that it was the frequently overlooked *C. similis* of Berkeley and Broome. It is probable that other mycologists have noted the association of *Ozonium* with *Coprinus*, but I have been unable to find any published account of their observations.

THE FUNGI OF GERMINATING FARM SEEDS.

By A. Lorrain Smith.

PLATE IX.

For the last two years I have been assisting in the botanical work undertaken for the members of the Royal Agricultural Society by the consulting botanist, and during that time I have had a great deal to do with testing the germination of grasses, clovers, and other farm seeds. If the seeds are slow in germinating or unsound, they are liable to be attacked by various fungi, and it has been interesting to note the constantly recurring moulds. The saucers on which the seeds are germinated are thoroughly cleansed by immersion in strong acid solution, and by subequent washing and scrubbing. It is impossible in such

work absolutely to preclude fungoid infection from the surrounding atmosphere during the progress of germination; but all ordinary means are employed to secure cleanliness and speedy growth of the seeds; and the evident conclusion is that the spores of most of the fungi that develop in the germination case have been brought into the laboratory with the samples. The rough pods of sainfoin carry most spores, and become very thickly covered with a rich mycelial growth. Smooth seeds, such as rye-grass and meadow fescue, germinate, as a rule, without showing any mould. It is, however, the quality of the seed that is the influencing factor. Fresh, healthy, well-filled samples germinate without any trace of fungi appearing; others, of the same kind but from a different sample, become mouldy in a few days. Unless the seeds have quite lost their vitality, the fungi do not really injure them or prevent the embryo sending out its rootlets, and clovers can grow when the outer coat is invisible owing to a thick crop of *Chætomium*.

My list of fungi is not exhaustive, as some forms, no doubt, have escaped observation; but a varied and interesting collection has already been made.

The higher fungi are not largely represented; there are no Basidiomycetes; and, as yet, only three Ascomycetes have been noted. Two of these belong to *Chætomium*, a genus of Pyrenomycetes. They are saprophytic and superficial on whatever substance they grow. *Chætomium Kunzeanum* Zopf, which is perhaps the most frequently met with, has a small elliptical fruit crowned at the summit by a bristly head of olive-brown hairs, which are unbranched, wavy, and somewhat rough when mature. *C. elatum* Kunze, which occurs also very frequently on the same kinds of seeds, is darker in colour, and the hairs of the crown are branched and very rough from the beginning. The ascospores of both species are a dull olive-brown. They grow on decaying vegetation, *C. elatum* more especially on grass. In the germination case they grow on grasses and clovers, and occasionally on turnip seeds. There is no doubt that towards the end of each season, the laboratory must be well furnished with *Chætomium* spores, and that may doubtless account for some of the infection. I have germinated some of the ascospores on a gelatine plate, and have obtained a beautiful growth of the *Oidium*-like conidial form, a creeping mycelium with upright conidiophores bearing a terminal chain of conidia, but I have never detected any conidial growth on the seeds.

The remaining Ascomycete, *Gymnoascus Reesii* Baran., I found on carrot and on turnip seed. It usually grows on decaying organic substances such as dung, and it is easy to understand how the spores might be blown by the wind on to the ripening

seeds. *Gymnoascus* is one of the less highly organised Ascomycetes, the peridium is composed of loose much-branched yellowish hyphæ, which surround the fertile filaments. When mature, the walls of the small globose asci disappear, but the minute spores retain for a time the form of the ascus. The fungus was attached loosely to the spines of the carrot seed, and seemed to have little organic connection with it; in this resembling the *Chætomiums*, which often grow on the awns of the grasses. Many of the smaller fungi grow with very little nutrition; those I have been watching often spread from the seeds to the germinating saucer, and grow vigorously on the porcelain, apparently on nothing, though doubtless some seed had lain on the spot and left some of its substance behind.

The Hyphomycetes bulk very largely in this flora of seed-fungi. The two ubiquitous species *Aspergillus glaucus* Link, and *Penicillium glaucum* Link, appear continually. *Cephalosporium Acremonium* Corda, *Sporotrichum laxum* Nees, and *Acremonium alternatum* Link, are not infrequent. These all grow on decaying vegetation, and are very common moulds. *Trichoderma viride* Pers., the conidial form of *Hypocrea rufa*, I have found several times, and have cultivated it on a gelatine slide; there was a beautiful growth in three days of upright branching colourless conidiophores bearing the groups of bright green spores at the tips of the branches. A form of *Sepedonium*, plate IX. fig. 1, entirely colourless, formed a white tuft on a grass seed. The spores, which are borne at the tips of delicate hyphæ, are globose and rather large, measuring about 18-20μ in diameter. They have a thick epispore, and are warted when mature. It agrees with the characters given of the species *S. xylogenum* Sacc., which has been found in Italy growing on wood. I have also to record in the Mucedineæ a specimen of *Botrytis vera* Fr., distinguished from other members of the genus by the lax branching of the sporophores. It grew on turnip seed.

Among the Dematieæ, *Macrosporium commune* Rabenh., the conidial form of *Pleospora herbarum*, occurs most frequently. *Helminthosporium gramineum* Rabenh. I have detected once on a grass seed. It is a parasite of cereals, destroying the leaves and so weakening the plant and injuring the grain. Some barley affected by it was sent into the laboratory during the summer of 1900. I have one record of *Stachybotrys alternans* Bonord. It is a fairly common mould, and grows by preference on damp blotting paper. *Stysanus stemonites* Corda, one of the Stilbeæ, by no means a rare fungus, has occurred several times on grass seeds.

Fusarium roseum Link, which formed its delicate rose-tinted cushions on clover seed, is a member of the Tuberculariеæ. In

a culture I made, it grew in a very straggling fashion, and budded off a succession of spores from the tips of the branches. It has been recorded on decaying leaves and stems. Another species, *F. commutatum* Sacc. (plate IX. fig. 2), is new to this country; it falls under Saccardo's group "*sporodochia laxa, effusa, byssina.*" On clover seed it hardly looked like a *Fusarium*, but on a culture plate it formed lax cushions; the spores are three-septate and measure 20—25 × 4—5μ. There is one difference between this species and the type in that the sporophores are septate, otherwise Bonorden's drawing exactly represents the habit of the fungus, and "*sporophoris continuis*" may not be a constant character.

There are two forms of Hyphomycetes that have puzzled me a good deal. The first grew on a seed of *Festuca pratensis* and from the character of the hyphæ and spores I have placed it in the hitherto monotypic genus *Langloisula* of Ellis and Everhart. The hyphæ are much larger, the spores also are larger, more deeply coloured, and not so pear-shaped as in the American species, *L. spinosa.* I therefore consider it to be a distinct species, and have named it *L. macrospora* (plate IX. fig. 3). I fear the genus, however, rests on too narrow a foundation of divergence from other forms, and the species might have been included in *Acremoniella.* The other specimen has baffled all my attempts to place it under any recorded genus. It is in form and habit something like a *Stemphylium*, and, but for lack of colour, I would have classed it under that genus. There is only one genus recorded under the group Mucedineæ-hyalodictyeæ, and it is entirely different in form from the fungus I have been dealing with. I have been compelled to establish a new genus, which I have named *Stemphyliopsis* g. n., to connect it with its nearest ally among the Dematieæ the species I have called *heterospora*, plate IX. fig. 4. The spores are exceedingly varied in form and size, and are borne at the tips of short branches from the main hyphæ. They are warted when mature, and the whole plant remains colourless after some weeks' culture. I succeeded in reproducing it on a gelatine plate. I got the original specimens on turnip seed and on clover seed.

The Mucorineæ are the sole representatives of the Phycomycetes that have appeared in the germinating case, and *Rhizopus nigricans* Ehrenb. most frequently of all. It grows on any kind of seed, though on the whole it is partial to the grasses. It spreads very quickly, and in time extends over the whole available space. I have found another form also with rootlets somewhat similar to those of *Rhizopus*, which on that account I have included in the same genus. The sporangiophores rise singly from the runner-like hyphæ, and near the top they form

an umbel of four short branchlets, each of which is terminated by a subglobose smooth sporangium. The tip of the branchlet expands gradually into the subglobose columella, to the base of which part of the sporangium wall remains attached after the dispersal of the spores. The whole plant is entirely colourless; the spores are small, oblong, and blunt at the ends. From the mode of branching I have named it *Rhizopus umbellatus* (plate IX. fig. 5). In one instance I found the main sporangiophore terminate in a sporangium with one side branchlet imperfectly developed; all the other examples have the umbellate head of branches. I have only found it once on clover seed, associated with another *Mucor*. It is entirely microscopic, and I have not succeeded in cultivating it. The *Mucor* in which it was entangled, if indeed it was not parasitic on it, I have determined to be *Mucor erectus* Bain. (plate IX. fig. 6). It forms delicate silky white tufts 2 or 3 centimetres in length. The hyphæ branch frequently, and the very unequal branches terminate in a small yellowish sporangium. A distinctive feature of this species is the septum that is always present just above the point where the branch is given off. I found it on turnip and carrot seeds, and I got a further abundant growth on a mixture of gelatine and bean decoction. *Mucor erectus* has been found in Europe on bread, plum decoction, and potatoes, but this is the first record for Britain. I have not yet been able to induce the growth of zygospores. *M. racemosus* Fres. (plate IX. fig. 7) appeared on clover seeds. It is easily recognisable from the chlamydospores which are produced in great abundance on the hyphæ and sporangiophores. I hardly think it is new to this country, but I cannot find any published record of its occurrence. It grows on a great variety of substances, and is very common on the Continent.

EXPLANATION OF PLATE IX.*

Fig. 1.—*Scpedonium xylogenum* Sacc. *a*, branches with developing spores from a culture × 500. *b*, mature spores × 500.

,, 2.—*Fusarium commutatum* Sacc. *a*, sporophores with developing spores × 90. *b*, mature spores × 500.

,, 3.—*Langloisula macrospora* sp. n. Fertile branches and spores × 500.

,, 4.—*Stemphyliopsis heterospora* g. et sp. n. Fertile hyphæ and spores × 500.

,, 5.—*Rhizopus umbellatus* sp. n. *a*, sporangiophore with columellae × 90. *b*, sporangium × 250. *c*, rootlets × 250. *d*, spores × 500.

,, 6.—*Mucor erectus* Bain. *a*, sporangiophore × 250. *b*, columella × 500, spores × 500.

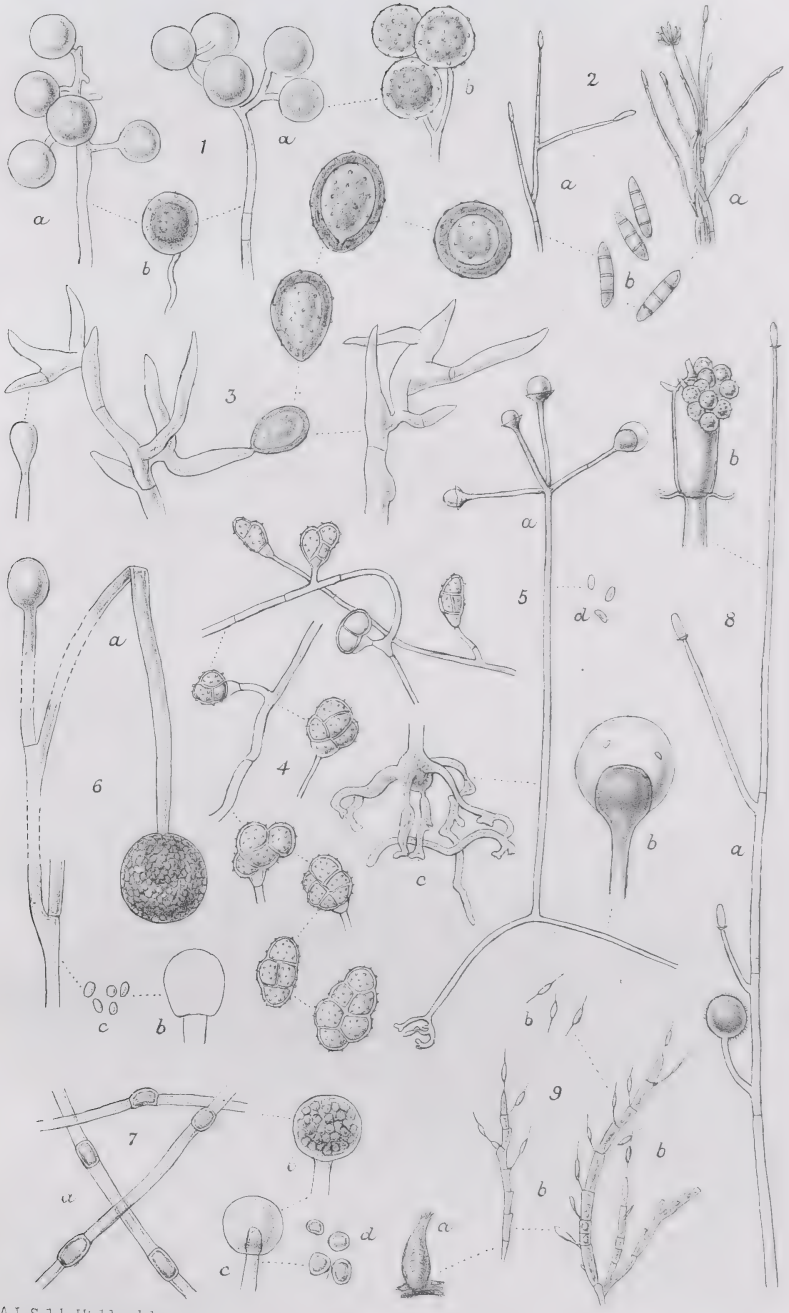
,, 7.—*Mucor racemosus* Fres. *a*, hyphæ with chlamydospores × 250. *b*, sporangium with spores × 250. *c*, empty sporangium × 250. *d*, spores × 500.

,, 8.—*Mucor spinosus* Van Tiegh. *a*, branching sporangiophore × 90. *b*, columella and spores × 500.

,, 9.—*Sphæronemella oxyspora* Sacc. *a*, pycnidia × 35. *b*, sporophores and spores × 500.

*(By kind permission of the Royal Microscopical Society).

Plate IX.



A.L.S. del. Highley lith.

Hanhart imp.

SPORE-FORMATION IN SACCHAROMYCETES.

B. T. P. Barker, M.A., Gonville and Caius College, Cambridge.

In 1883 Hansen (1) published the results of his experiments on the conditions necessary for the formation of spores in the *Saccharomycetes.* They were as follows:—

1. The cells must be placed on a moist surface and have a plentiful supply of air.
2. Only young, vigorous cells can exercise this function.
3. The formation only proceeds between certain temperature limits, the limits varying for different species. The most favourable temperature for most species is about 25° C.

Previously little was known concerning the necessary conditions, and since that time Hansen's results have been generally accepted, until last year, when Klebs (2) suggested that the real condition had been overlooked by Hansen, viz.:—The want of food, or, to put it more particularly, the sudden change from very favourable nutritive conditions to a state, more or less, of starvation. Recently another element has also entered into the question. Three species, viz.:—*Saccharomyces octosporus*, *S. Pombe*, and *Zygosaccharomyces*—require a process of conjugation and nuclear fusion before spores are formed, with the exception of a few isolated cases in *S. octosporus.* Janssens and Leblanc (3), in their work on the yeast nucleus also have stated that *S. cerevisiae* and other allied species require nuclear fusion before fertile spores can be produced.

The following experiments have been undertaken with a view of testing these statements, and can be divided into two groups, viz.:—

I. Those in which the effect of external conditions is studied.

II. Those dealing with the conditions of the cells themselves, *i.e.*, internal conditions.

I. In all the following experiments, except where otherwise stated, the method of testing the capability of the cells to form spores under any given set of conditions consisted in pouring a few drops of beer-wort, containing actively-growing yeast cells upon a square block of Plaster of Paris, about an inch thick, contained in a covered glass dish. This was moistened with distilled water and placed at 25° C. The yeast cells were obtained in an active condition by infecting a tube of beer-wort,

allowing it to stand for 24 hours at 25° C, and then infecting a fresh tube from it, which was also kept for 24 hours at 25° C. *Saccharomyces cerevisiae* Hans. and *S. anomalus* Hans. were the species used.

The first set of experiments consisted in testing the effect of the porosity of the block upon which the spore-culture is made, it being suggested by Klebs that the function of the Plaster of Paris block was to serve as a means to separate the food materials from the cells. Obviously, then, the more porous the material the better separation there would be.

The substances used were Plaster of Paris, a pad of filter paper, porous porcelain of two kinds, cardboard, and pieces of a plant pot. These are arranged in the order of their porosities, the first two being equally porous. These were placed in separate covered glass dishes, and were moistened with a few drops of distilled water after the beer-wort had been soaked up. The vegetation on them was examined after 48 hours in the series, where *S. cerevisiae* was the species used; and it was found that the number of spores produced varied according to the porosity of the material. Arranging the materials in the order of the number of spores formed thereon, the arrangement corresponds exactly to that given above as representing the porosities of the materials.

A similar experiment was made, using *S. anomalus* Hans. in the place of *S. cerevisiae*. The vegetation in this case was examined after 72 hours, a longer time being required for the formation of spores in this species. The results here corresponded exactly to those in the preceding case.

At first sight these results seem to support Klebs' view, but it must be borne in mind that not only does better porosity imply better separation of food material, but also better æration. In the case of a poorly porous substratum, the cells are immersed in comparatively large drops of liquid, while a very porous substratum leaves the cells practically exposed to the air, being kept moist by the large amount of aqueous vapour rather than a film of liquid.

An attempt was then made to estimate the effects of the presence or absence of nutrient substances. Five sets of spore-cultures were made:—

a. In which the blocks were kept moist with fresh beer-wort.

b. In which the blocks were kept moist with a mixture of 25 per cent. fresh beer-wort and 75 per cent. distilled water.

c. In which the blocks were kept moist with a mixture of 10 per cent. beer-wort and 90 per cent. distilled water.

d. In which the blocks were kept moist with distilled water only.

e. In which the blocks were suspended in large beakers of distilled water, the surfaces of the blocks on which the yeast cells were situated being kept above the level of the liquid.

In *d* the only food material present was that contained in the few drops of beer-wort poured over the gypsum block, and in which the yeast cells had been actively growing for 24 hours.

In *e* a similar amount would be present at the start of the experiment, but by diffusion into the large quantity of distilled water contained in the beaker the cells would be practically denuded of all nourishment.

With *S. cerevisiae* an abundant supply of spores was obtained in *d* and *e*; in *c* the number was fair; in *b* moderate; and in *a* none were formed. The number of spores produced for this species, then, was inversely proportional to the amount of food material present.

In the case of *S. anomalus*, however, an opposite result was obtained. No spores were formed in *e*, while *d*, *c*, *b*, and *a* formed an increasing series. The number of spores in this case, then, was directly proportional to the amount of food material present.

These results correspond well with certain facts that have already been observed in different cultures of the two species. *S. cerevisiae* forms no spores in streak cultures on various nutrient gelatine or agar media, nor in nutrient solutions. *S. anomalus*, on the other hand, forms spores abundantly in streak cultures on beer-wort gelatine, or agar, and also in solutions of various sugars.

Klebs' view, then, cannot hold for *S. anomalus*. It has been suggested that the variations in osmotic pressure might have something to do with these results. A series of cultures was therefore made, in which the gypsum blocks were moistened with solutions of KNO_3 (also NaCl) of different strengths. The solutions of KNO_3 and NaCl were of the following strengths:—

a.	10	grams KNO_3	to 100 c.c. of water.
b.	5	grams KNO_3	"
c.	2·5	grams KNO_3	"
d.	1·25	grams KNO_3	"
e.	5	grams NaCl	"
f.	2·5	grams NaCl	"
g.	1·25	grams NaCl	"
h.	·65	grams NaCl	"

and control blocks moistened with distilled water in the case

of *S. cerevisiae* and with fresh beer-wort in the case of *S. anomalus* were also prepared.

For *S. cerevisiae*, *b*, *c*, *d*, *f*, *g*, and *h* showed as good a spore yield as the control blocks, while *a* and *e* gave a less abundant spore formation. Hence for this species comparatively great osmotic pressure variations had no effect on the spore formation, and it was only in the case of very large alterations that the yield was materially affected.

For *S. anomalus* spores were only produced on the control blocks. This points to the fact that for this species the presence of food is a necessary condition, while variations of the osmotic pressure have little or no effect within moderate limits, since spores are formed when the blocks are kept moist with beer-wort of different strengths.

Variations in the æration of the cells were then tried. Cultures were placed in (*a*) an atmosphere of pure CO_2, (*b*) air containing considerably more CO_2 than normal, (*c*) ordinary air, (*d*) air freed from CO_2 by potash. *S. cerevisiae* and *S. anomalus* gave corresponding results. No spores were produced in *a* or *b*. In *c* there was a good spore yield, and in *d* an even better yield. The blocks used for the culture of *S. anomalus* were moistened with fresh beer-wort instead of distilled water. The æration, therefore, has a direct effect on the spore-production, the presence of CO_2 tending to inhibit it.

The effect of moisture apparently varies according to the different conditions under which the experiment is conducted. Four cultures on gypsum blocks were placed as follows:—

a. In air kept dry by calcium chloride. No moisture added beyond that supplied by the few drops of beer-wort, which served as the source of the cells.

b. In ordinary air. Moisture added as in *a*.

c. In air. Blocks kept moist by addition of small quantity of distilled water.

d. In air. Blocks standing in distilled water.

The results for *S. cerevisiae* showed that *b*, *c*, and *d* gave very good yields of spores, but none were produced in *a*, the cells having dried up. The results for *c* and *d* hold good in those cases where the surface of the block is kept nicely moist without, however, becoming sloppy. Some gypsum blocks, on the addition of liquid, crumble somewhat and in cases the surface exposed to the air becomes pasty and the block is therefore rendered much less porous, and in extreme cases the beer-wort is never properly soaked up. Naturally, also, the æration of the cells on such blocks is very poor; and, as one would

expect from the preceding results, the yield of spores is very small and often nothing. In all experiments in which the blocks behaved in this fashion, the blocks were rejected.

Summing up the results thus obtained, we find that for *S. cerevisiae*—

1. The yield of spores is directly proportional to the porosity of the material used for the culture block.
2. The yield of spores is inversely proportional to the amount of food material present.
3. Large quantities of CO_2 inhibit the spore formation; and the less the amount of CO_2 present the better the yield.
4. Variations in osmotic pressure up to the amount exerted by 5 per cent. KNO_3 solution do not affect the yield. Ten per cent. potassium nitrate solution retards spore formation.
5. The amount of moisture present does not affect the yield unless the æration of the cells is too greatly interfered with.

For *S. anomalus* the conclusions are similar with the exception of 2. In this case the yield of spores is directly proportional to the amount of food material present.

The results, on the whole, support Hansen's view that good æration is necessary for spore formation. This seems to be the necessary condition in all cases for both species. Klebs' view apparently receives support by the behaviour of *S. cerevisiae*. But may it not be that for this and other vigorously fermenting species, when fermentable sugars are present in any considerable quantity, a large amount of CO_2 is produced, and that the presence of this gas serves to inhibit the spore formation? At any rate, Klebs' view cannot hold good for *S. anomalus*, and it is quite possible that the numerous other species which also form spores on various nutrient media may behave in the same way as this species.

II. *The influence of internal conditions on spore formation.*

a. The cells must be in a vigorous state of growth. This is effected by twice successively cultivating the cells in fresh beer-wort for 24 hours at 25° C. The necessity of this condition is easily proved by making spore cultures with cells of *S. cerevisiae* 24 hours, 48 hours, 72 hours, &c. old. The only case in which an abundant spore yield is obtained is when cells 24 hours old are used. Few spores are formed in other

cases, and none, as a rule, where the cells are more than 48 hours old.

b. Possibly a sexual process is necessary. *(See Note.)*

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NOTE.—An account of the sexual process, occurring in certain Yeasts, has recently been published. (*Barker.* Sexual Spore-Formation in Yeasts. Ann. Bot. Dec. 1901.) A short discussion of the question of the sexuality of the Saccharomycetes in general will be found in that paper.

FUNGI NEW TO BRITAIN.*

By Annie Lorrain Smith, &c.

Mucor erectus Bain. Ann. Sci. Nat. Ser. 6, Vol. 19, p. 207.

Sporangiophores upright, somewhat flaccid, forming silky tufts up to 1 c.m. or more high, much branched, the branches varying in length, septate just above the insertion of each branch; sporangia terminal on the main stem and branches, small, globose up to 120μ in diameter, somewhat yellowish, transparent, smooth; columella globose, usually about 40μ in diameter; spores elliptical, varying in size, mostly flat on one side, 5-10μ × 2·5-5μ, colourless, shewing dark in the mass; zygospores globose, 40-65μ in diameter, the exospore yellowish or reddish-brown, with darker, star-like, flat markings; azygospores similar to the zygospores; gemmae varying in form, finely spinous, colourless.

On bread, decaying potatoes, &c. Found on farm-seeds that were being tested for germination. Norwood, June, 1901. Pl. ix., fig. 6.

* Owing to lack of space it has been impossible to reprint the descriptions of species that have already been published in this country other than those on Plate IX. The student is referred to the Journals quoted in this list for a complete account of the fungi new to science or new to Britain.

M. spinosus Van Tiegh. Ann. Sci. Nat., Ser. 6, Vol. 4, p. 390.

Sporangiophores upright, stiff, up to 1 c.m. high, branched, septate above the insertion of the branches; sporangia terminal on the main stem and branches, small, globose, about 100μ in diameter, at first colourless, becoming dark-brown or black, covered with delicate spines; sporangium wall disappearing, leaving a basal collar; columella cylindrical or pyriform, with one or more short, irregular outgrowths at the top; spores globose, 5-9μ in diameter, greyish-brown, smooth; zygospores globose, yellowish-brown, the exospore with dark, irregular, lamelliform markings that rise to a point; gemmae formed in the hyphæ.

On horse dung, vegetable refuse, &c. Found on a leaf of a cherry tree from Kent, July, 1901. The spores were not smooth as given in Van Tieghem's diagnosis, they were finely echinulate. In other respects the specimen agreed with the description of the type. Pl. ix., fig. 8.

M. racemosus Fres. Beitr. z. Mycol., p. 12.

Sporangiophores upright, stiff, varying in height, forming brownish-yellow patches, irregularly much branched; sporangia globose, small, varying in size, 20-70μ in diameter, somewhat yellowish, transparent, sporangium wall persistent, with small incrustations of lime, and a short basal collar; columella broadly clavate, varying in size, 17-60μ long, 7-30μ broad at the base, 9-42μ above, sometimes globose, spores globose, or shortly elliptical or angular, 5-8μ × 6-10μ, smooth, yellowish in the mass; zygospores globose, 70-85μ in diameter, brownish, the exospore beset with reddish-brown, bluntly conical warts; gemmae or chlamydospores always in great abundance in every part of the hyphæ, colourless or yellowish, smooth, very variable in form, 11-20μ × 20-30μ or globose, 20μ in diameter.

On all decaying matter. Found on farm-seeds. Norwood, June, 1901. Pl. ix., fig. 7.

Rhizopus umbellatus A. L. Sm. Pl. ix., fig. 5.

Spreading hyphæ with sucker-like roots, delicate, about 8-10μ in width; sporangiophores rising singly from the runner-like hyphæ up to 500μ in length, and branching above in an umbellate manner; secondary branches usually four, sometimes septate, slightly wider at the top, and terminated by a subglobose sporangium 50 × 60μ; sporangium-wall delicate, attached to the base of the columella; columella globose, 30μ in diameter; spores minute, oblong, blunt, 5 × 2μ. The whole plant colourless.

On a seed of red clover in the germinating case, entangled with Mucor erectus. Norwood, June, 1901.

Monilia Glasti Plowr. Journ. Bot. 1901, Vol. 39, p. 385.

On woad balls, Parson Drove Woad Mill, Cambridgeshire.

Sterigmatocystis nigra Van Tiegh.

On stale bread, Kew. Mr. E. S. Salmon in Quekett Micr. Journ., Ser. 2, Vol. 7, p. 373. Pl. 20, figs. 8-10.

Sepedonium xylogenum Sacc. Mich. ii., p. 552. F. ital. t. 715.

Tufts effused, white, subpulverulent, hyphæ filiform, obsoletely septate; fertile branches, simple or furcate, conidia acrogenous, globose, asperulate, colourless, 15-18μ in diameter.

On dead wood. Found on farm-seeds. Norwood. Pl. ix., fig. 1.

Fusarium commutatum Sacc. Syl. iv., p. 710.

Tufts broadly effused, white, floccose; conidiophores irregularly branched; conidia at first somewhat globose, then fusiform, 3-septate, 20-25 × 5μ, slightly curved, colourless.

On potatoes. Found on germinating farm-seeds. Pl. ix., fig. 2.

Langloisula macrospora A. L. Sm. Pl. ix., fig. 3.

Fungus consisting of entangled, much-branched, septate hyphæ, 5-8μ in width, the branches varying much in length from 12-40μ, tapering to a sharp point, colourless, bearing a single spore, at the tip; spores brown, ovate, with a thick epispore, slightly pointed towards the base, where there is a small clear spot, warted when mature, 25-30 × 15-20μ.

On a grass seed in the germinating case. Norwood.

Stemphyliopsis A. L. Sm.

Hyphæ intricately branched, colourless, septate; spores terminal on the branches, elliptical or subglobose, 2-many-septate and muriform, colourless.

S. heterospora A. L. Sm. Pl. ix., fig. 4.

Growing in tufts up to 2 mm. in height, consisting of a tangled mass of colourless rather delicate hyphæ with numerous short branchlets; spores varying in form and size, elliptical, from 12 × 8μ up to 25 × 15μ or subglobose about 15 × 12μ, transversely septate and 2 or more-celled or cruciate and muriform, colourless, warted when mature.

On clover and turnip seed in the germinating case. Norwood.

Helminthosporium obclavatum Sacc. Mich i. p. 85, F. ital. t. 52.

Effused, forming large black spots; hyphæ erect, filiform subincrassate at the base, 60-70μ × 6-7, with few septa, fuliginous brown;

conidia acrogenous, solitary, obclavate-fusiform, gradually attenuate upwards, about 90 × 15, round at apex, base wedge-shaped, truncate, 18-24-septate, dark brown.

On decaying wood. Exeter, September, 1901.

Stilbum leiopus Ehren.

Stalk stout, smooth, white, gradually tapering to a subglobose depressed, rose-coloured head, the whole fungus having a somewhat clavate appearance.

Found by Mr. Hey on the dung of the wood mouse, Scabba wood, Yorkshire. The Naturalist, November, 1901, p. 342.

Endomyces Reess, Bot Unters. ueb. Alkoholgähr, p. 77.

Mycelium creeping, much branched, mostly parasitic, asci solitary on the ends of short, simple side branches, globose or pyriform, 4-spored, spores one-celled.

E. coprophilus Mass. and Salm. Ann. of Bot., Vol. 15, p. 324. Pl. xvii., fig. 35.

On horse dung, Kew.

Myxotrichum uncinatum Schröet.

On rabbit dung, Kew. Mass and Salm. loc. cit., p. 325. Pl. xvii., figs. 30-32.

Cenangium Sarothamni Fuckl. Sym. Myc. p. 270.

On dry branches of *Sarothamnus scoparius*, Scarborough, Yorkshire. G. Massee. The Naturalist, June 1901, p. 178.

Thelebolus stercoreus Zukal (sic.)

On rabbit dung. Mass and Salm. loc. cit., p. 326. Figs. 41-44, 66. The authors are evidently dealing with the fungus already recorded in these Transactions p. 115 under *T. nanus*. The plant *Thelebolus stercoreus* was originally named and described by Tode. Messrs. Massee and Salmon, following Continental Fungologists, have ignored the original author and his description of *T. stercoreus* which was a fairly large plant, the size of a poppy seed. The plants found at Reigate and Kew did not exceed 240μ in diameter.

Ryparobius ascophanoides Sacc.

On rabbit dung, Kew. Mass. and Salm. loc. cit., p. 327. Figs. 33, 34.

Ascobolus perplexans Mass. and Salm. loc. cit., p. 328. Figs. 52-55.

On dung of elephant, red-deer, horse etc., from London and neighbourhood.

Saccobolus quadrisporus Mass. and Salm. loc. cit. p. 329. Figs. 48-51.
On dung of ass, Kew.

Mollisia nervicola Gill.
On under surface of decaying oak leaves; mostly on the nerves. Hebden Bridge, J. Needham. Naturalist, June 1901, p. 180.

Belonidium Clarkei Mass. and Crossl. Naturalist, June, 1901, p. 181, pl. i., figs. 1-6.
On damp rotten wood. Whitby, September, 1900. A. Clarke.

Lachnea contorta Mass. and Crossl. Naturalist, June, 1901, p. 182, pl. i., figs. 7-11.
On naked ground. Selby, Yorkshire. G. Massee.

L. Lojkaeana Rehm.
On the ground, Hebden Bridge, Yorkshire. Naturalist, June, 1901, p. 183.

Dasyscypha inquilina Wint.
On *Equisetum sylvaticum*, Hebden Bridge. J. Needham. Naturalist, June, 1901, p. 183.

D. vitreola (Karst.) Mass. Naturalist, June, 1901, p. 183. Pl. ii., figs. 12-16.
On dead Blackberry stems. Kew. G. Nicholson.

Humaria carneola Wint.
Growing on living moss, Sutherlandshire. Mr. E. S. Salmon, Quekett Micr. Journ., Ser. 2, Vol. 7, p. 373. Pl. xx., figs. 4-7.

H. Nicholsonii Mass. Naturalist, June, 1901, p. 188. Pl. ii., figs. 17-21.
On dead Beech leaves. Kew. G. Nicholson.

Mitrophora rimosipes Lév.
On the ground. Edith Weston, Rutland. Miss Crowther-Baynon. Naturalist, June, 1901, p. 189.

Microsphæra Bäumleri P Magn.
On *Vicia sylvatica*. New Pitsligo, Scotland. Mr. E. S. Salmon, Quekett Micr. Journ., Ser. 2, Vol. 7, p. 371. Pl. xx., figs. 1-3.

Pleuroascus Nicholsoni Mass. and Salm. (g. et sp. nov.) Ann. of Bot., Vol. 15, p. 330. Pl. xvii., fig. 25.
On dung of guinea pig. Kew, January, 1901. Coll. Geo. Nicholson.

Eurotium insigne Wint.

On dung of kangaroo, horse, &c. Mass. and Salm. loc. cit., p. 331. Figs. 29, 39-40.

E. microsporum Mass. and Salm. loc. cit., p. 333. Fig. 28.

On dung of guinea pig, goat, sheep, &c.

Magnusia Sacc. Mich. 1, p. 123.

Perithecia superficial, at first globose, then horizontally elliptical or angular, without an ostiole, black, at each end or corner provided with a strand of 2-6 long, brown appendages; asci pyriform, evanescent, 8-spored; spores elliptical, 1-celled, brown; no paraphyses.

M. Bartlettii Mass. and Salm. loc. cit., p. 333. Fig. 26.

On dung of guinea pig, wild sheep, &c.

Sphæroderma fimbriatum Rostr.

On dung of guinea pig. Kew. Mass. and Salm. loc. cit., p. 351. Fig. 23.

S. Hulseboschii Oud.

On rabbit dung. Leith Hill, Surrey. Mass. and Salm. loc. cit., p. 352. Figs. 57-61.

Melanospora discospora Mass. and Salm. loc. cit., p. 352. Figs. 36-38.

On dung of ibex and wild sheep. Kew.

Sordaria globosa Mass. and Salm. loc. cit., p. 334. Fig. 21.

On dung of kangaroo and red deer. Kew.

S. anserina Wint.

On goose dung. Kew. On dung of kangaroo and giraffe. Loc. cit., p. 334. Fig. 6.

S. minima Sacc. and Speg.

On dung of rabbit and hare. Kew. Loc. cit., p. 335. Fig. 11.

S. hirta Hans.

On cow dung. Kew. Loc. cit., p. 336. Fig. 7.

S. setosa Wint.

On dung of rabbit, deer, sheep, &c. Loc. cit., p. 336. Fig. 13.

S. curvicolla Wint.

On rabbit dung. Kew. Loc. cit., p. 337. Fig. 12.

S. pleiospora Wint. Bucknall, No. 825.

On dung of giraffe. Kew. Loc. cit., p. 338. Fig. 14.

S. macrospora Auersw.

On dung of hare and kangaroo. Kew. Loc. cit., p. 339. Fig. 9.

S. neglecta Hans.

On cow dung. Reigate. Loc. cit., p. 339. Fig. 15.

S. Winteri Karst.

On horse dung. Kew. Loc. cit., p. 340. Fig. 5.

S. fimiseda Ces and de Not., var *appendiculata* (Auersw.)

On dung of Mexican deer. Kew. Loc. cit., p. 340. Fig. 16.

Delitschia moravica Niessl.

On rabbit dung. Reigate. Loc. cit., p. 343. Fig. 18.

D. insignis Mout.

On horse dung. Epping Forest and Kew. Loc. cit., p. 344. Fig. 20.

Sporormia longipes Mass. and Salm., loc. cit., p. 346. Fig. 1.

On dung of deer, goat, &c. Kew.

S. ovina Sacc.

On rabbit dung. Kew. Loc. cit., p. 346. Fig. 4.

S. pulchella. Hans.

On horse dung. Kew. Loc. cit., p. 347. Fig. 2.

S. fimetaria de Not.

On cow dung. Aboyne, Scotland. Loc. cit., p. 347. Fig. 19.

Microascus Zukal Ueb. eine neue Pilze, Myx. and Bakt., p. 9.

Perithecia globose, ostiolate, carbonaceous, smooth or covered with stiff hairs; asci spherical, 8-spored, formed from the swollen ends of hyphal branches, evanescent; spores unequal-sided, elliptical or lunate, brown or reddish-brown, smooth.

M. variabilis Mass. and Salm. loc. cit., p. 349. Fig. 24.

On dung of Patagonian cavy. Kew.

M. nidicola Mass. and Salm. loc. cit., p. 350. Figs. 62-65.

On an old nest of a wild bee along with *Myxotrichum setosum* and *Arachniotus candidus*. (These two latter fungi are also new to the British flora).

Spumatoria longicollis Mass. and Salm. (g. et sp. nov.) loc. cit., p. 350. Fig. 27.

On horse dung. Epping Forest.

Poronia leporina Ellis and Everh.

Stipitate, flesh coloured, small, stipe 1-2 mm. long, $\frac{1}{2}$ mm. thick, expanding above into a discoid stroma 1-2 mm. in diameter, and mammillose from the slightly prominent perithecia which are ovate-globose, about $\frac{1}{2}$ mm. in diameter, 6-20 in a stroma; ostiola large, black, convex; asci clavate-cylindrical, 80-100 (*p. sp.* 75-80) × 10-12μ, with obscure paraphyses; spores at first greenish-hyaline, becoming opaque, subinequilaterally elliptical, mostly uniseriate, 12-15 × 6-7μ.

On rabbit dung. Cadeby, Yorkshire. Naturalist, November, 1901, p. 341.

Sphæronemella oxyspora (Berk.) Sacc.

Perithecia minute, subulate, straw-coloured, glistening; spores elliptical, appendiculate at both ends up to 7μ × 2μ, appendages 3μ in length.

On a dead agaric. Llanymawddwy, N. Wales. Pl. ix., fig. 9.

Thelephora vitellina Plowr.*

Pileus pale egg-colour, flabelliform, expanded upwards, superior margin rimose, slightly incurved laterally. Hymenium rugulose, zoneless. Stem attenuated downwards, but enlarged at the base. Pileus $\frac{1}{4}$-$\frac{1}{2}$ or $\frac{3}{4}$ in. across (10-18 mm.), 1-1$\frac{1}{2}$ in. (20-30 mm.) high, spores oval, 3 × 1-1·5μ.

On a dead fir branch amongst moss, and in the interior of a fir tree. Boat of Garten, September, 1900. Mr. Scott Elliot and Mr. Angus Grant, 1901.

Specimens were sent to M. Boudier, who pointed out its resemblance to *T. sowerbei* B. and Br., from which it differs in its pure yellow colour and lignicolous habit, as well as in the small size of its spores.

Polyporus (Fomes) Euonymus Kalch.

On the base of the stem of *Euonymus Europæus* near Salisbury.

* See p. 119 and 123.

Mr. E. J. Tatum, 1899. Dr. C. B. Plowright in Journ. Bot., Vol. 39, p. 385.

Agaricus perrarus Schulzer. Bres. Fung. Trid., p. 82, pl. 89.

Pileus 6-14 cm. and more broad, fleshy, campanulate, then expanded, yellow, covered with dense imbricate Lepiota-like fulvous scales. Stem 9-11 cm. long by 1½ to 3 cm. thick, incrassated at the base, whitish, covered below the ring with evanescent fulvous scales, floccosely stuffed, then hollow. Ring white, becoming discoloured, large, superior and reflexed. Flesh white, soft, that of the stem turning yellowish when sectioned. Gills crowded, free, and often very remote, equally attenuated at both ends, 5 mm. broad, white, then rosy, and finally fuscous. Spores obovate, purplish fuscous, 7-9 × 4-5μ.

Amongst grass under an oak. Claines, Worcestershire, 26th August, 1901. Mr. Carleton Rea.

Polyporus flavo-virens B. and Rav.* Centur. N. Amer. Fungi, n. 43.

Pileus 8-10 cm. broad, soft, pulvinate or depressed, irregularly lobed, subtomentose, dirty yellowish-green, flesh white, stem 5 cm. long by 2-3 cm. thick, incrassated upwards, pallid, of the same colour as the pileus. Pores ½ mm. deep, very decurrent, angular, very irregular and with thin dissepiments, finally torn, at first white, then yellowish-green; spores spindle-shaped, dirty green, 15-18 × 7-8μ.

Under Pinus sylvestris. Boat of Garten, Invernessshire, 21st September, 1900. Rev. D. Paul, LL.D.

Femsjonia Summ. Veg. Scand., p. 341.

Cup-shaped, distended with firm jelly, different on the two sides, disc thick, heterogeneous, even and not glandular. Sporophores immersed, globose, the oblong spores curved.

Growing on wood, erumpent, brightly coloured.

Femsjonia luteoalba Fr. Hym. Eur., p. 695.

Cup 2-13 mm. across at first convex, then plain, bright golden yellow, externally white and mealy, rooting and erumpent. Spores 12-22 × 7-8μ, boat-shaped, multiseptate at maturity. Basidia 75-80μ, with two long sterigmata, 35-40μ.

On birch and oak. Newton Saint Cyres, Devon, 25th and 27th September, 1901. Dr. C. B. Plowright.

"This fungus is probably far from rare, but has hitherto been overlooked in this country, owing to the fact that it retains its cup-like form only during the earlier stages of its existence. During the

* This species was doubtfully referred at p. 120 and 122 to Gyrodon?

Fungus Meeting of the Cryptogamic Society of Scotland held at Edinburgh in October, 1878, in the excursion to Penicuik, I found a specimen of what I took to be this fungus growing upon an oak stick, while in company with the Rev. John Stevenson. Unfortunately this specimen, which consisted of two or three cups, was lost—it fell out of the basket during the excursion—so that I was never able to be certain of its identity. At Exeter, however, several specimens were found upon birch and oak, by both Mr. Rea and myself. It is only in the young stage that the white tomentose exterior is visible. In the early stages it at first reminds one, as Fries indicates, of a Bulgaria or *Exidia recisa*. He goes further in suggesting Sowerby's figure of *Peziza radiculata*, t. 114. As the plant grows, it soon loses its cupulate or obconic form; flattening out, it becomes disc-shaped, but very soon convex. The upper surface is then thrown into folds, and the plant becomes what is often called *Tremella torta* Willd, although the true *T. torta* is a much smaller fungus. The evanescence of the white tomentum and the rapid loss of its cup-shaped form are the reasons this interesting fungus has been so long overlooked by us in Great Britain."—C.B.P.

RULES.

Society's name and objects.

1. The Society shall be called "The British Mycological Society" and its objects shall be the study of Mycology in all its branches, systematic, morphological and pathological, the publication of annual reports recording all recent discoveries in any branch of mycology, and more especially giving a brief synopsis of the work of European Mycologists and the recent additions to the British Fungus Flora.

Members of Society.

2. The Society shall consist of Foundation Members, Honorary Members and Ordinary Members, the number of Foundation Members shall be limited to 100 and that of Honorary Members to 20, but the number of Ordinary Members shall be unlimited.

Foundation Members.

3. Foundation Members shall consist of those Members and Clubs who joined the Society previous to the limit of 100 Members of the Society having been attained, but after this number has been attained no Person or Club shall be admitted as a Foundation Member.

Honorary Members.

4. Honorary Members shall be Ladies or Gentlemen of pre-eminence in Mycology, or who have rendered special service to the Society.

Ordinary Members.

5. Ordinary Members shall be Ladies or Gentlemen elected as hereinafter set out.

Election of Members.

6. Until the limit of 100 Foundation Members be reached any person or Club may signify their desire of joining the British Mycological Society and will

consequently be enrolled as Members thereof by the Secretary. Honorary Members shall only be elected at a meeting of The British Mycological Society by the majority of the Members then present. Ordinary Members shall be elected either by the majority of the Members then present at the annual meeting, or meetings, or by the President, Vice-President, Treasurer, and Hon. Secretary at other times. All Ordinary Members shall be proposed and seconded respectively by existing Members, who shall sign a certificate (see appendix) in recommendation of him or her, one at least of the proposers so certifying from personal knowledge, and every candidate for election shall sign an undertaking to abide by the Rules if elected (see appendix).

Yearly Subscription.

7. All Ordinary Members and Clubs shall pay an annual subscription of 10/- and Foundation Members 5/-, and the same shall be due by the First of January in each year, whilst Honorary Members shall be exempt from any annual subscription. Any Member wishing to retire from the Society shall give notice to the Hon. Secretary in writing before 1st of December of the previous year, otherwise he shall be liable for the annual subscription for the next year.

Government of the Society.

8. The management of the British Mycological Society shall be vested in the President, Vice-President, Treasurer, and Hon. Secretary.

Election of Officers.

9. The President, Vice-President, Treasurer, and Hon. Secretary shall be elected annually, at the first meeting of the British Mycological Society in each year, by a majority of the Members then present.

Meetings or Forays.

10. The British Mycological Society shall hold one or more meetings annually at a place and time determined by the Members at the previous meeting, or in default thereof, by the President, Vice-President, Treasurer, and Secretary. Invitations from Local Societies shall be first entertained and the acceptance of such shall imply that the Local Society undertakes to arrange the excursions of the foray,

obtain necessary permissions from landowners, and place at the disposal of the British Mycological Society a room, free of cost, for the exhibition of specimens, delivery of addresses, and the transaction of business.

Accounts to be annually furnished and vouched.

11. At the first meeting of the British Mycological Society in each year the Hon. Secretary shall produce an account of the receipts and disbursements for the previous year duly vouched by the Hon. Treasurer, or if the two offices be combined, then by an independent Member of the Society.

Payment of Expenses.

12. At each Meeting the Members then present must pay to the Hon. Secretary their share of the expenses incurred.

Election of Chairman in absence of President and Vice-President.

13. In the absence of the President and Vice-President, the Members present at any meeting shall elect a Chairman for that Meeting.

Rarities to be recorded.

14. Members finding rare specimens, or specimens new to the British Fungus Flora, are requested to immediately communicate the fact to the Hon. Secretary, together with full descriptions, the locality, habitat, and the date thereof, and the Hon. Secretary shall report the same at the next meeting of the Society.

Every Member to have a copy of these Rules and any alteration thereof.

15. A printed copy of these Rules shall be sent to every Member of the Society on election, and to all Members on their alteration.

APPENDIX.

Form of proposal for Ordinary Membership of the British Mycological Society.

_____

of _____

_____

being desirous of becoming an Ordinary Member of the British Mycological Society, we, the undersigned Members of the Society, certify that we consider h to be a desirable Member of the Society, and beg to recommend h for election.

Dated this day of 19.

_____ (From personal knowledge).

_____

Certificate to be signed by the Candidate.

I hereby certify that I desire to become an Ordinary Member of the British Mycological Society and that I will abide by the Rules if elected.

_____

LIST OF FOUNDATION MEMBERS, 1901.

1. Acland, Sir Charles Thomas Dyke, Holnicote, Taunton, Somerset.
2. Balfour, Professor Isaac Bayley, M.A., M.D., F.R.S., Inverleith House, Edinburgh.
3. Biffen, Mr. R. H., M.A., 6, Claremont, Cambridge.
4. Bird, Mr. C. P., I.C.S. retired, J.P., F.R.H.S., Drybridge, Hereford.
5. Birks, Mr. Thomas, Southdene, Eaglescliffe, R.S.O.
6. Blackman, Mr. V. H., British Museum (Natural History), Cromwell Road, London, S.W.
7. Boston, The Mycological Club, Boston, Mass., U.S.A.
8. Burrell, Mr. W. H., Sheringham, Norfolk.
9. Carr, Professor J. W., M.A., University College, Nottingham.
10. Clarke, Dr. Fielding, Wayside, Wateringbury, Tunbridge, Kent.
11. Clarke, Rev. F. K., M.A., Orcheston, Malvern Wells.
12. Cooke, Dr. M. C., 53, Castle Road, Kentish Town, London, N.W.
13. Crawford, Mr. W. C., M.A., F.R.S.E., 1, Lockharton Gardens, Edinburgh.
14. Crossland, Mr. Charles, F.L.S., 4, Coleridge Street, Halifax.
15. Dublin, The Field Naturalists' Club, 5, Ely Place, Dublin.
16. Edwards, Mr. W. H., Curator, Hastings Museum, Victoria Institute, Worcester.
17. Eyre, Rev. W. L. W., M.A., Swarraton Rectory, Alresford, Hants.
18. Farmer, Professor J. Brentland, M.A., F.R.S., Botany Laboratory, Normal School, S. Kensington, S.W.
19. Fitz-Gerald, Rev. H. P., F.L.S., Barracane, Wellington College, Berks.
20. Fowler, Rev. W., M.A., Liversedge Vicarage, Narmanton.
21. Gardner, Mr. Frederic, 11, Nevill Street, Abergavenny.
22. Gelsthorp, Mr. Thomas, Eastgate, Louth.
23. Gibbs, Mr. Thomas, 43, St. Ronan's Road, Sheffield.
24. Green, Mr. C. Theodore Green, M.R.C.S. England, L.R.C.P. London, F.L.S., 31, Shrewsbury Road, Birkenhead.
25. Hey, Mr. T., 8, Bloomfield Street, Derby.
26. Hughes, Mr. G. C., Rousham, Oxford.
27. Jenkin, Mr. Charles Frewen, 4, Vanburgh Park Road, West Blackheath.
28. Johnson, Professor T., D.Sc., Science and Art Museum, Kildare Street, Dublin.

29. Louth, The Antiquarian and Naturalists' Society, Louth.
30. Macfie, Mr. John William Scott, B.A., Rowton Hall, Chester.
31. Mackenzie, Mr. D., 12, James Watt Street, Glasgow.
32. Mason, Dr. Philip B., Trent House, Burton-on-Trent.
33. Montague, Mrs. A., Penton, Crediton, N. Devon.
34. Oliver, Professor F. W., M.A., D.Sc., Botany Laboratory, University College, Gower Street, London, W.C.
35. Paul, Rev. David, LL.D., 53, Fountainhall Street, Edinburgh.
36. Peacock, Dr. H. G., The Homestead, Monkton, Combe, near Bath.
37. Pim, Mr. Greenwood, M.A., Easton Lodge, Monkstown, Co. Dublin.
38. Pipe, Mr. Charles, Broad Street, Worcester.
39. Plowright, Mr. Charles B., M.D., King's Lynn.
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The

British Mycological Society.

(Recognosce notum, ignotum inspice.)

Established 1896.

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1902-1906.

Vol. II.

Edited by Carleton Rea.

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THE HEREFORD FORAY.

22nd to 27th September, 1902.

The sixth annual week's Fungus Foray was held at Hereford, on the invitation of the well-known Woolhope Naturalists' Field Club, which in former days had done so much to foster and encourage the study of mycology by bringing its devotees together at their annual forays. The Woolhope Club very kindly placed at the disposal of the British Mycological Society their Club Room at the Public Library, and numerous works on mycology. The members assembled at the Woolhope Club Room, Hereford, on Monday, the 22nd of September, and a few specimens were put out on exhibition. Mr. Charles T. M. Plowright brought from Putney some nice examples of *Merulius Guillemoti* Boud., a species which the Hon. Secretary said he had found on the stands at the cricket ground at Worcester in June, 1902. He also brought from Epping Forest *Flammula decipiens* W. G. Smith; *Polyporus cuticularis* Fr., *Fomes applanatus* Wallr., and *Trametes cinnabarina* Jacq., and Mr. Rea some specimens of *Geoglossum hirsutum* Pers. and *glabrum* Pers., from the Forest of Dean.

On Tuesday, the 23rd of September, the famous Dinmore Woods were explored, and some good finds rewarded the members, viz.: *Geaster rufescens* Pers., *Lactarius scrobiculatus* Fr., *Leptonia euchroa* Pers., *Marasmius Vaillantii* Fr., and two Clavariæ new to the British Fungus Flora, namely, *Clavaria Michelii* Rea=*Clavaria fragilis* Holmsk. var. *C. gracilis* Pers., and *Clavaria subtilis* Pers., the latter, however, had been gathered in the Forest of Dean at a meeting of the Worcestershire Naturalists' Club on the 16th of September, 1902, and Dr. Plowright gathered the rare *Clavaria rufa* Fl.D., and *Omphalia retosta* Fr. In the evening the Society's dinner was held at the Green Dragon Hotel, and afterwards at the Headquarters (the Woolhope Room), the presidential address was read on behalf of the President, Professor W. H. Trail, M.D., F.R.S., who was at the last moment imperatively prevented from attending the meeting. It was entitled, "Distributional Records," and dealt chiefly with the following questions. Did some plant appear to be indigenous? If of recent origin, could it be determined when, how, or whence it came? How was it related to its environment? Was it extending its range or becoming less common? What was its relation to man

in the district? He then pointed out minute methods for recording such observations on detailed maps, and thought that such a process was applicable to fungi.

On Wednesday, the 24th of September, the members started at mid-day from the Headquarters in carriages for the grounds and woods of Belmont and Haywood Forest. Amongst the specimens collected we note fine examples of *Lycoperdon echinatum* Pers., *Marasmius urens* Fr., and *Hudsoni* Fr. (at its original station at Belmont), *Tubaria crobula* Fr., *Boletus castaneus* Bull., *Mycena olivaceomarginata* Mass., *Pluteus umbrosus* Pers. and *Clavaria dissipabilis* Britz. At the evening meeting at the Headquarters the Hon. Treasurer reported that he had at that date a balance of £24, but that donations to the printing fund would still be gratefully received, as the cost of their Transactions still exceeded their income by a good deal, the cost of plates being, as they all knew, very expensive, but absolutely necessary to maintain the Transactions in a state of efficiency. The Hon. Secretary reported that eighty-three members had now been enrolled as foundation members, of which fifty-three may now be considered as on the active list. Since his last report four new members have joined the Society, namely—Dr. C. Theodore Green, M.R.C.S., England, L.R.C.P., London, F.L.S., Professor J. Brentland Farmer, F.R.S., The Library and Philosophical Society, Newcastle-upon-Tyne, and the Missouri Botanical Garden, St. Louis, Mo., U.S.A., and one resignation has been received from Mr. E. S. Salmon. The election of officers was then proceeded with, and the Rev. W. L. W. Eyre, M.A., was unanimously elected President; Professor H. Marshall Ward, D.Sc., F.R.S., & Vice-President, and Mr. Carleton Rea, B.C.L., M.A., was prevailed upon to accept the post of Hon. Secretary and Treasurer for another year. It was decided that the next annual week's foray should be held in Savernake Forest, with Marlborough for headquarters, in the first week of October, 1903.* A short note was then read on behalf of their member, Dr. C. Theodore Green, F.L.S., on "*Cintractia cingens*" De Toni, which he had found in July, 1902, growing upon Linaria vulgaris at Glyndyfrdwy, in Denbighshire, in a shady lane near the river Dee. "The foliage of the Linaria which had not flowered looked chlorotic, to use a medical phrase that fits the condition exactly. A closer examination of these yellowish-green shoots shewed that both stem and leaves presented slatey coloured streaks that were evidently well within the tissues. On placing sections beneath the microscope the cause of this was shewn to be numerous dark brown spores arranged in groups around the long axis of the stem and the midrib of the leaves. Some underground shoots, blanched through lack of sunlight, shewed the same slatey colour from the same cause, though

* Monday the 5th October to Saturday the 10th October, 1903.

in less degree. This is the first recorded appearance of this Ustilago in Britain, and it is rare even on the Continent of Europe." And Mr. Carleton Rea, B.C.L., M.A., read a note on "A very abnormal form of *Agaricus arvensis* Schaeff," illustrated by a painting by Mrs. Rea. "The specimen was deposited on the exhibition table of fungi at the Victoria Institute, Worcester, in the autumn of 1902 by a person unknown. The upper surface of the Pileus was normal, but the whole of the underside was covered with gills very labyrinthiform, poriform, anastomosing and daedalioid in character; the gills were very shallow, but the spores were normal. No trace of a stem was extant, and the only explanation of this abnormal condition which he could offer was this: He presumed that the pileus was separated from the stem by somebody gathering mushrooms, or by some other animal agency, and this separation is easily effected as the flesh of the stem is not confluent with the flesh of the pileus. Did not the hymenial hyphæ after the removal of the stem develop the hymenium on the whole of the under surface of the pileus, including that portion originally occupied by the stem, or did the vegetative hyphæ become potential hymenial hyphæ? This raised a broad question, as hitherto it had been considered that at some preceding stage the hyphæ had been differentiated into hymenial and vegetative. Sports as a rule now-a-days are considered to give some indication of the ancestry of a species, and the present example probably shewed that the differentiation of the hyphæ had only been recently acquired."

On Thursday, the 25th of September, the members drove from the Headquarters at 12 o'clock to Rotherwas, from whence a walk was taken through the woods to Dinedor Camp. In Rotherwas wood Dr. Plowright secured many examples of *Rosellinia clavariae* Tul., and *Eccilia atropuncta* Pers., whilst other members collected fine specimens of *Cortinarius (Phlegmacium) triumphans* Fr., *Hygrophorus subradiatus* var. *lacmus* Fr. and *Clavaria stricta* Pers. In the evening, at the Headquarters, Mr. R. H. Biffin, M.A., gave a very interesting lecture on "Some facts in the life history of *Acrospeira mirabilis* B. and Br." (see p. 17); Miss A. Lorrain Smith read "Notes on a species of Stilbum" (see p. 25), and a paper on "Lindroth's classification of the Uredineæ of the Umbelliferæ" (see p. 26), was read on behalf of Dr. C. B. Plowright. Hearty votes of thanks were then accorded to the Woolhope Naturalists' Field Club for placing their Club Room and books at the disposal of the British Mycological Society, to Dr. H. Cecil Moore for the great trouble he had taken in arranging the details of the foray and obtaining the necessary permissions from landowners and tenants and for personally conducting them through their daily excursions, and to the landowners and tenants for their kind permission to visit their estates, and Dr. H. Cecil Moore was further requested to convey these resolutions to the proper persons, a task which he most kindly undertook to do.

On Friday, the 26th of September, the members assembled at the Headquarters at mid-day and drove to Holme Lacy Park, the seat of the Earl of Chesterfield. Here the Park and adjoining woods were thoroughly searched and yielded several interesting species, including *Pleurotus applicatus* Batsch., *Entoloma Saundersii* Fr., *Stropharia caput-Medusae* Fr., *Cortinarius (Phlegmacium) balteatus* Fr., *Paxillus giganteus* Fr., *Hygrophorus fornicatus* Fr., *H. calyptraeformis* B. and Br., *H. nitratus* Fr., and *Daldinia concentrica* Ces. & de Not. on birch.

Over 385 species were collected during the week, and Miss A. Lorrain Smith subsequently reported that the foray at Belmont had produced one mould new to Britain, *Monilia candicans* Sacc., and another which the Editor also regards as new to the British Flora, viz., *Stysanus fimetarius* Karst. on decaying vegetable matter, as he does not consider that Messrs. Massee's and Salmon's enumeration of it as occurring on the dung of Sinaitic Ibex and Common Camel can possibly be regarded as a British record thereof.

Complete List of Fungi gathered during the Foray.

Amanita phalloides Fr., mappa Fr., pantherina Fr., muscaria Fr., rubescens Fr.

Amanitopsis vaginata Roze.

Lepiota procera Scop., rachodes Vitt. and var. puellaris Fr., excoriata Schaeff., cristata A. and S., granulosa Batsch.

Armillaria mellea Vahl., mucida Schrad.

Tricholoma sejunctum Sow., acerbum Bull., flavo-bunneum Fr., albobrunneum Pers., rutilans Schaeff., columbetta Fr., terreum Schaeff., saponaceum Fr., cuneifolium Fr., carneum Bull., melaleucum Pers., sulphureum Bull., panaeolum Fr., grammopodium Bull.

Clitocybe clavipes Pers., odora Bull., rivulosa Pers., maxima Fl. Wett., infundibuliformis Schaeff., geotropa Bull., inversa Scop., metachroa Fr., fragrans Sow.

Laccaria laccata Scop.

Collybia radicata Relh., longipes Bull., platyphylla Fr., fusipes Bull., maculata A. and S., butyracea Bull., vertirugis Cke., confluens Pers., tuberosa Bull., acervata Fr., dryophila Bull., rancida Fr.

Mycena pelianthina Fr., Iris Berk., olivaceo-marginata Mass., pura Pers., luteo-alba Bolt., rugosa Fr., galericulata Scop., polygramma Bull., alkalina Fr., ammoniaca Fr., filopes Bull., sanguinolenta A. and S., galopoda Pers., epipterygia Scop., tenerrima Berk., discopoda Lev., capillaris Schum.

Omphalia retosta Fr., grisea Fr., fibula Bull.
Pleurotus applicatus Batsch.
Pluteus cervinus Schaeff., umbrosus Pers.
Entoloma sinuatum Fr., lividum Bull., Saundersii Fr., jubatum Fr., sericellum Fr., sericeum Bull., nidorosum Fr.
Clitopilus prunulus Scop.
Leptonia lampropoda Fr., serrulata Pers, euchroa Pers.
Nolanea pascua Pers., picea Kalchbr., infula Fr.
Eccilia atropuncta Pers.
Claudopus variabilis Pers.
Pholiota praecox Pers., radicosa Bull., squarrosa Müll., spectabilis Fr.
Inocybe lanuginosa Bull., pyriodora Pers., incarnata Bres., fastigiata Schaeff., rimosa Bull., asterospora Quél., geophylla Sow., scabella Fr., and tricholoma A. and S.
Hebeloma fastibile Fr., mesophaeum Fr., crustuliniforme Bull.
Flammula decipiens Sm., flavida Schaeff.
Naucoria melinoides Fr., escharoides Fr.
Galera tenera Schaeff., hypnorum Batsch.
Tubaria furfuracea Pers., crobula Fr.
Crepidotus mollis Schaeff.
Agaricus arvensis Schaeff., campestris Linn., var silvicola Vitt., silvaticus Schaeff., hæmorrhoidarius Kalchbr., comtulus Fr.
Stropharia æruginosa Curt., albo-cyanea Desm., inuncta Fr., squamosa Fr., thrausta Kalchbr., and var aurantiaca Cke., semiglobata Batsch., caput-Medusæ Fr.
Hypholoma sublateritium Schaeff., fasciculare Huds., pyrotrichum Holmsk., velutinum Pers., appendiculatum Bull., hydrophilum Bull.
Psilocybe semilanceata Fr., var caerulescens Cke., fœnisecii Pers.
Psathyra corrugis Pers.
Anellaria separata Karst.
Panæolus papilionaceus Fr., campanulatus Linn.
Psathyrella gracilis Fr., atomata Fr.
Coprinus comatus Fr., atramentarius Fr., fimetarius Fr., var cinereus Schaeff., niveus Fr., micaceus Fr. plicatilis Fr.
Bolbitius fragilis Fr.
Cortinarius (Phlegmacium) triumphans Fr., balteatus Fr., varius Fr., largus Fr., caerulescens Fr.
(Myxacium) elatior Fr., delibutus Fr.
(Inoloma) pholideus Fr.
(Dermocybe) tabularis Fr., caninus Fr., lepidopus Cke., sanguineus Fr., cinnamomeus Fr.
(Telamonia) torvus Fr., impennis Fr, hinnuleus Fr., brunneus Fr., hemitrichus, Fr., paleaceus Fr.
(Hygrocybe) dolabratus Fr.
Paxillus giganteus Fr., involutus Fr.

Hygrophorus cossus Fr., discoideus Pers., pratensis Fr., virgineus Fr., niveus Fr., fornicatus Fr., subradiatus Fr., var lacmus Fr., laetus Fr., ceraceus Fr., coccineus Fr., miniatus Fr., puniceus Fr., conicus Fr., calyptræformis B. & Br., chlorophanus Fr., psittacinus Fr., nitratus Fr.

Lactarius scrobiculatus Fr., torminosus Fr., turpis Fr., pubescens Fr., insulsus Fr., blennius Fr., circellatus Fr., uvidus Fr., pyrogalus Fr., chrysorheus Fr., piperatus Fr., vellereus Fr., deliciosus Fr., pallidus Fr., quietus Fr., aurantiacus Fl. Dn., glyciosmus Fr., serifluus Fr., mitissimus Fr., subdulcis Fr.

Russula nigricans Fr., adusta Fr., chloroides Kromb., furcata Fr., depallens Fr., lepida Fr., vesca Fr., cyanoxantha Fr., foetens Fr., fellea Fr., emetica Fr., ochroleuca Fr., fragilis Fr. var violacea Quél., aurata Fr., nitida Fr. var pulchralis Britz., alutacea Fr., armeniaca Cke., lutea Fr.

Cantharellus cibarius Fr., tubæformis Fr., infundibuliformis Fr.

Nyctalis parasitica Fr.

Marasmius urens Fr., peronatus Fr., oreades Fr., Vaillantii Fr., ramealis Fr., rotula Fr., androsaceus Fr., Hudsoni Fr., epiphyllus Fr.

Panus conchatus Fr., stipticus Fr.

Lenzites betulina Fr.

Boletus elegans Schum., flavus With., granulatus Linn., piperatus Bull., chrysenteron Fr., subtomentosus Linn., edulis Bull., luridus Schaeff., laricinus Berk., versipellis Fr., scaber Fr., castaneus Bull.

Fistulina hepatica Fr.

Polyporus squamosus Fr., picipes Fr., giganteus Fr., dryadeus Fr., hispidus Fr., cuticularis Fr., mollis Fr., betulinus Fr., adustus Fr.

Fomes ulmarius Fr., connatus Fr., fomentarius Fr., annosus Fr., applanatus Wallr., ferruginosus Fr.

Polystictus perennis Fr., versicolor Fr., hirsutus Fr.

Poria vaporaria Fr., medulla-panis Fr.

Trametes gibbosa Fr., cinnabarina Jacq.

Daedalea quercina Pers.

Merulius corium Fr., Guillemoti Boud.

Hydnum repandum Linn., rufescens Pers., auriscalpium Linn.

Radulum orbiculare Fr.

Grandinia granulosa Fr.

Craterellus cornucopioides Pers., sinuosus Fr.

Thelephora fastidiosa Fr.

Stereum purpureum Pers., hirsutum Fr., spadiceum Fr., rugosum Fr.

Corticium sambuci Fr., sanguineum Fr., comedens Fr.

Hymenochaete tabacina Lév.

Peniophora quercina Cke., cinerea Cke.

Coniophora puteana Mass.
Clavaria muscoides Linn., cinerea Bull., cristata Pers., rugosa Bull., subtilis Pers., stricta Pers., rufa Fl. Dan., fusiformis Sow., inæqualis Fl. Dan., fragilis Holmsk., Michelii Rea, dissipabilis Britz , pistillaris Linn.
Auricularia mesenterica Fr.
Calocera viscosa Fr., stricta Fr.
Tremella lutescens Fr., tubercularia Berk.
Exidia glandulosa Fr.
Scleroderma vulgare Fr., verrucosum Pers.
Cyathus striatus Hoffm.
Crucibulum vulgare Tul.
Sphaerobolus stellatus Tode.
Lycoperdon echinatum Pers., excipuliforme Scop., gemmatum Batsch., pyriforme Schaeff., plumbeum Pers., nigrescens Vitt.
Geaster rufescens Pers., fimbriatus Fr., Bryantii Berk.
Ithyphallus impudicus Fisch.
Mutinus caninus Fr.
Hysterographium Rousselii Sacc., Belmont.
Propolis faginea Karst., Dinmore.
Karschia lignyota Sacc., Holme Lacy.
Orbilia leucostigma Fr., Holme Lacy.
Bulgaria polymorpha Wettstein.
Ombrophila clavus Cke.
Coryne sarcoides Tul.
Tapesia caesia Fckl.
Lachnea scutellata Gillet.
Dasyscypha hyalina Mass., Belmont.
Humaria omphalodes Mass.
Peziza succosa Berk.
Helvella crispa Fr., lacunosa Afzel., macropus Karst.
Leotia lubrica Pers.
Spathularia clavata Sacc.
Geoglossum glabrum Pers., hirsutum Pers.
Nectria coccinea (Pers.), Holme Lacy.
Trichosphaeria barbula (B. and Br.), Holme Lacy.
Diatrype stigma Fr., Belmont.
Hypoxylon udum Fr., Holme Lacy, fuscum (Pers.)
Rosellinia Clavariæ (Tul.), and the conidial condition known as Scolecotrichum clavariarum Sacc., on Clavaria cinerea Bull.
Ceratostomella cirrhosa Sacc., Holme Lacy.
Anthostoma melanotes Sacc., Holme Lacy.
Daldinia concentrica Ces. and de Not., on birch.
Xylaria hypoxylon Lin.
Physarum nutans Pers., bivalve Pers.
Craterium pedunculatum Trentepohl.

Leocarpus vernicosus Link.
Chondrioderma spumarioides Rost.
Didymium difforme Duby.
Comatricha obtusata Preuss.
Reticularia Lycoperdon Bull.
Trichia persimilis Karst., fallax Pers., varia Pers.
Arcyria punicea Pers.
Monilia candicans Sacc., Belmont.
Cephalosporium acremonium Corda., Belmont.
Botrytis cinerea Pers., Belmont.
Torula antennata Pers., Dinmore.
Periconia pycnospora Fres., Belmont.
Stysanus fimetarius Karst., Belmont.

M.C.C. del. West, Newman chr.

Collybia pulla Schaeff.

RECENT BRITISH FUNGI.

By M. C. Cooke.

WITH PLATE I.

Amanita cariosa Fries. Hym. Eur. p. 24.

Pileus convex, then plane, soft, even, unequally clad with mealy patches ($3\frac{1}{2}$-$4\frac{1}{2}$ in.), flesh white, stem stuffed then hollow (4-5 in. long, $\frac{3}{4}$ in. thick), fragile, nearly equal, smooth; superior ring, at length falling away; gills adnate, then seceding, and free spores 10μ long. Sacc. Syll., 32. Gonn. and Rabh., t. 9, f. 3.

In woods. Huddersfield, September, 1895.

Fries places it near *A. spissa*.

Schulzeria lycoperdoides Cooke and Massee.

Pileus convex, then expanded, soft, tan-coloured, beset with darker pyramidal warts, resembling those of some species of *Lycoperdon*, and often splitting at the base; margin appendiculate, stem equal, solid, minutely fibrillose, whitish; gills rather crowded, free, white.

On the ground, under cedars. Kew.

Pileus $1\frac{1}{2}$ in. broad. Stem 2 in. long. Spores oval. $5 \times 4\mu$.

Armillaria caligata Viviani. F. Ital., t. 35.

Smell strong. Pileus compact, convex, then plane, tawny, weasel-colour, spotted with adpressed silky squamules of the same colour; stem solid, beneath the persistent membranaceous ring zoned with brown squamules; gills emarginate, white. Sacc. Syll., No. 266. Arm. focalis, minor. Cooke Illus., t. 245.

On the ground, chiefly pine woods.

Stem 3-4 in. long, nearly 1 in. thick. Pileus 3 in. Spores globose 3-4μ diam. Doubtless *A. causetta* Barla. should be included in the same species.

Collybia pulla Schaeff., t. 25. Fries Ep., p. 114.

Pileus fleshy, thin, campanulate, then expanded, obtuse, even, smooth, hygrophanous; stem hollow, twisted, somewhat striate, soft, naked; gills adnexed, rather broad, transversely pellucid-striate, whitish. Sacc. Syll., 767. Bolton, t. 15.

Under birch, &c. Highbeech, Epping.

Stem premorsely rooting (3 in. long), cuticle sott, polished. Pileus fragile, purplish bay, nearly black, paler when dry (1 in. high, $1\frac{1}{2}$ in. broad). Spores 10μ long.

Collybia subelevata W. G. Smith.

Pileus submembranaceous, tough, campanulate, obtuse, dry, floccose, opaque, brown ($2\frac{1}{2}$ in. high, 4 in. broad). Stem elongated, hollow, rather slender, slightly attenuated upwards from the premorse base, flocculose, pale-brown (7 in. long, $\frac{1}{4}$-$\frac{3}{8}$ in. thick); gills adnexed, distant, very broad ($\frac{5}{8}$ in.), white.

In woods, amongst stumps. Epping.

Hygrophorus latitabundus Britz. Hygr. IV., fig. 14.

Pileus fleshy, convex, then expanded, smooth, sooty, becoming yellowish, with a tendency to olive; stem solid, firm, thick, viscid, rather scaly above; gills subdecurrent, distant, white. Sacc. Syll., No. 1568.

In woods. Street, Somerset.

Pileus 3-4 in. broad. Stem 3-5 in. long, 1 in. thick. Spores smaller than in *H. limacinus* (10×6-7μ); It is a larger and more robust species and has been confounded with it.

Hygrophorus clivalis Fries. Mon. II. p. 134.

Whitish, fragile, pileus thin, disc more fleshy, campanulate, then expanded, shining not viscid, margin at first bent inwards, then spreading, striate; stem solid, short, fragile, attenuated downwards; gills rather narrowed behind, almost free, ventricose, distant, and somewhat thick. Sacc. Syll., No. 1607. *Hygrophorus fornicatus* Cooke Illus., t. 933.

On damp slopes. Holme Lacy.

Smaller than *H. fornicatus*, with which it has been confounded. Spores $6\text{-}7 \times 4\mu$.

Marasmius sclerotipes Bres. Fun. Trid., p. 12, t. XI., f. 1.

Pileus membranaceous, convex, margin inflexed, then plane, umbilicate, rugulose-striate, white, umbilicus yellow, subflocculose (6-8 mm. broad); gills distant, adnate, white, margin fimbriate; stem filiform, pruinose under a lens, pallid rufescent, apex whitish; base adnate to a yellowish rufescent sclerotium, equal (12-18 mm. long, $\frac{1}{2}$-1 mm. thick). Sacc Syll., No. 2232. Collybia cirrhata Cooke Illus., t. 144 B.

On the ground in swampy places. Epping Forest.

In Cooke's Illustrations this was referred to *Collybia cirrhata*, with

the authority of the Rev. M. J. Berkeley, and strong urgency of Dr. H. Bull. Afterwards it was equally strongly contested and opposed by Dr. Max. Cornu. Undoubtedly according to Fries, *Collybia cirrhata* has no sclerotium, and the figure by Batsch, No. 95, thus represents it. Examination of specimens collected this year has led me to confess to the error, whilst referring them to Bresadola's *Marasmius*.

Glœosporium Bidgoodi Cooke.

Pustules rather large, covered by the blackened cuticle, at length ruptured for the escape of the conidia. The stroma upon which the conidia are produced is also blackened, but the conidiophores become hyaline above, bearing the narrowly elliptic conidia ($18\text{-}20 \times 4\mu$) which have two nuclei. No direct evidence that eventually they become uniseptate. Journ. Roy. Hort. Soc. XXVI., pp. CXXXIX. and CXLI.

On leaves of *Odontoglossum*.

Has been known for six or seven years, but not described. Leaves were submitted to Mr. Bidgood in 1901, who declared it to be a species of *Glœosporium*, but we have awaited his description in vain, and now take leave to associate it with his name. The conidia of *Glœosporium Vanillæ* are $14\text{-}16 \times 6\text{-}7\mu$; those of *G. cinctum* are $10\text{-}15 \times 2\frac{1}{2}\text{-}3\mu$; those of *G. oncidii* are $14\text{-}17 \times 4\frac{1}{2}\text{-}6\mu$; those of *G. orchidearum* are $20\text{-}25 \times 5\text{-}7\mu$; and those of *G. affine* are $14\text{-}20 \times 4\text{-}6\mu$, but other features have to be taken into account as well as the dimensions of the conidia.

Fusarium lini Bolley. U.S.A. Agr. Exp. St., N. Dakota. Bull. 50, 1901.

Vegetative hyphæ, light coloured, septate, branching irregularly, ramifying the tissue of the stems and roots of the host. Spore tufts (sporodochia) erumpent, compact, slightly raised, pale cream or flesh coloured. Sporophores short and closely branched, or conidia sometimes arising from wart-like protuberances, upon a common bed, or stroma. Conidia 4-celled, fusiform, slightly curved or falcate ($27 \times 3\mu$ to $38 \times 3\frac{1}{2}\mu$).

Living in the humus of the soil, attacking the seedlings of the flax plant, causing the disease known as "flax wilt." N. Ireland.

Already known in Holland, Belgium, Northern France, Germany and Ireland, but hardly known in Russia.

Coniothecium Questieri Desm. Pl. Crypt, 1857, p. 2.

Epiphyllous. Tufts superficial, very minute (25μ diam.), numerous, subspherical, effused, gregarious, black, shining. Conidia 6-10

conglobate in versiform glomerules, compressedly angular, brown, semi-opaque (10μ diam.). Sacc. Syll. IV., No. 2442.

On fading and dead blotches on leaves of apple. Sci. Com., R.H.S.

Scarcely to be deemed a parasite, as evidently it is not the cause of the withering of the leaves. Compared with authentic specimens and found to be the same. Originally discovered on leaves of *Cornus*.

Œdomyces leproides Trabut. Sacc. Syll. XI., p. 234.

Forming large nodulose, fleshy tumours on the upper part of the root of beet and on young potato tubers. Spores globose depressed, umber (40-50 × 30μ), acrogenous; mycelium inflated into a vesicle below the spores; spores produced in masses within spherical cysts in the substance of the tumours.

On beet root and potato tubers. Destructive.

Hitherto the tumours have been found in Britain on beet root, but without spores. Upon potatoes for the past two years the disease has been but too common, fully producing spores, and laying waste extensive crops. Dr. Magnus has determined the fungus of the potato tumour to be identical with that of the beet root, although it has been described under a different name as *Chrysophlyctis endobiotica* (Schilbersky).*

*Miss A. Lorrain Smith does not assent to this union (see p. 31 hereof).

ON SOME FACTS IN THE LIFE HISTORY OF *ACROSPEIRA MIRABILIS* (BERK. & BR.).

By R. H. Biffen, M.A.

With Plate II.

In the Annals and Magazine of Natural History for 1861 Berkeley and Broome described a curious mould fungus, found on Spanish Chestnuts at Bristol, under the name of *Acrospeira mirabilis*. The genus so founded* still remains monotypic, and beyond Berkeley's account of the development of the one spore form known to him, nothing further has been published with regard to its life history. It is always included in the Hyphomycetes in the Family of the Dematieæ on account of its dark-coloured "conidia."

Berkeley's detailed account of the fungus is to be found in his Introduction to Cryptogamic Botany (p. 305). I quote it in full. "But, perhaps, one of the most curious [Sepedonei†] is a species which occurs, not unfrequently, in imported Spanish Chestnuts. The white substance of the two large cotyledons is completely traversed and altered in texture by the mycelium of the mould, while a few fertile threads are produced in the free space between the cotyledons. If a slice of the diseased cotyledon be placed on damp soil under a bell-glass, in two or three days the threads are beautifully developed, and exhibit under the microscope a very curious condition. The tips of the fertile ramuli are curled into a little spiral, which after a time consists of about three articulations. All of these swell, but the second the most, so as to appear to be supported at its base by the other two. The integument becomes slightly rough and at length strongly granulated, like the spore of a *Genea*, and eventually, in some cases, a second spore is added at the tip."

Massee‡ describes the fungus also, but as follows:—"Sterile hyphae blackish-olive, floccose, interwoven, fertile, erect, vaguely branched above, tips of branches curved and closely septate; conidia subglobose, lateral near the tips of the branches, dark-coloured, minutely warted, 15-20 μ diam."

* Not to be confused with Acrospira (Mont.)

† Sepedonei. A subdivision of the Hyphomycetes with the fertile threads scarcely distinct from the mycelium, and the spores very abundant.

‡ A Text-book of Plant Diseases (p. 435).

Further (p. 305) "the ripe fruit of the sweet-chestnut (*Castanea vesca*, Gaertn.) is sometimes filled with a dense blackish-olive felt belonging to the fungus named above. Nothing as to the life history of the parasite is known." On comparing these descriptions one is at once struck by the fact that Berkeley makes no mention of this characteristic blackish-olive colour in his careful description of the fungus. This fact puzzled me for some time, for the fungus, as I found it and cultivated it, was obviously enough *Acrospeira mirabilis*, yet it showed no signs of this colouring. Further acquaintance with the fungi found in chestnuts has led me to conclude that Massee's description refers in part to one of the Dematieæ (which at present I cannot get to fruit), frequently occurring in them and traversing the whole nut with its olive-black hyphæ.*

Further, his figure in the British Fungus Flora, Vol. III., p. 358, fig. 13, does not agree with Berkeley's original description or figures, or yet with a specimen from Broome in the Cambridge University Herbarium. It is suggestive of an imperfect realization of the true meaning of Berkeley's account.

The chestnuts from which I obtained my supply of *Acrospeira* were bought in Cambridge. The only information I was able to obtain with them was that they were grown in all probability in the South of Spain, and that the disease in some seasons caused a considerable loss. This was clearly the case, for thirty-five out of fifty nuts first examined were found to contain the chocolate-coloured powder formed by the loose mass of spores. As the nuts were too dry for the fungus to have spread much during transit, I assume they were infected before importation. The spores often filled the space between the cotyledons, and more rarely were found in abundance immediately within the carpel wall. The diseased tissue, instead of being white and crisp, was a pale ashy-brown colour and more or less powdery. Where the disease was only partial a dark brown line marked the limits of the diseased portion. Microscopic observation showed that this zone was occupied by a vigorous intercalary mycelium, without haustoria, which brought about, probably by the secretion of a cytase, a marked swelling of the cell walls. It had no especially marked distribution, though, if anything, it was most abundant in the neighbourhood of the vascular bundles of the cotyledons. The strongly thickened carpellary walls showed no signs of attack. Mixed with the *Acrospeira* I often found *Penicillium glaucum* and *Phoma eriophorum* (Berk. and Br.). These were separated by means of plate cultures, and when a perfectly pure growth of *Acrospeira* was obtained, pieces of chestnut, sterilized by suc-

* It is probably a species of Haplographium.

cessive boilings in plugged tubes, were infected from it. Under these conditions the fungus grew vigorously, forming a hardly visible, silky, web-like coating of mycelium, which, in about ten days, seemed to be transformed into a dense brown powder, owing to the abundance of spores it produced. In old cultures this layer was often two or three millemetres in thickness. On examining cultures a week old, the mycelium was found to be septate, colourless, and strongly vacuolated. Arising from it were numbers of upright a-septate hyphæ, branching to form either a simple or compound raceme. The ultimate branches were almost invariably in groups of threes. The apices of these branches bent over crozier-fashion, swelled slightly, and then coiled into a close spiral of one-and-a-half turns (Fig. 1a). Three transverse septa then appeared in this closely coiled portion, and frequently a fourth one lower down the hypha. The penultimate cell of the group, i.e. the middle one of the three, then increased in size rapidly, while the others grew more slowly. The result of this unequal growth was to fuse the three cells into a group in which the original spiral arrangement was lost sight of (Fig. 1b). At this stage the contents of the penultimate cell became strongly vacuolated, and its wall gradually thickened, became brown in colour, and covered with large warts. Similar changes, but far less pronounced, occurred in the other two cells. Meanwhile further septa were formed in the fertile hyphæ, and the group of three cells was cut off as a whole. It now consisted of a thick-walled, warted spore, partially invested by the cells originally immediately above and below it, though now displaced by the unequal swelling (Fig. 1c). From its mode of development, the central spore was evidently a chlamydospore, not a conidium.

Berkeley, in his original description, makes mention of certain abnormalities, and a striking point in the life history of this fungus is the frequency with which they occur. Normally, the group of three spores has much the appearance of a teleutospore of *Triphragmium*, in which two of the cells are only partially developed, but occasionally owing to the development of the two upper cells only they resemble those of a *Puccinia*, while more rarely *Phragmidium*-like groups were met with. The last two forms can be produced in abundance in cultures on melon-rind. In size, the normal spores were from 25-30μ in diameter, but when grown under water they were frequently as much as 45μ, and with thin, translucent, smooth walls. Grown in a very dry atmosphere they were only some 15-18μ in diameter, while the walls were very massive, dark brown, and again wartless. These marked changes in size, colour and markings, make one wonder whether we do not often lay too much stress on spore

characteristics, particularly in separating otherwise somewhat similar species.

On germinating these chlamydospores the large, penultimate cell, and that one only, put out a mycelium. From its thick walls one might have concluded that it was a resting spore, like so many other chlamydospores, but it appears to be the spore form which serves for the rapid reproduction of the fungus, for it germinated in every case within forty-eight hours, usually in much less. The further development of the mycelium it formed was determined chiefly by the food supply available.

Thus, if the spores were sown on an extract of peas, made up with ten per cent. of gelatine, the mycelium grew slowly and remained altogether sterile, though transferred repeatedly to fresh supplies of pea extract. The sterile mycelium could, however, be induced to form a fresh crop of the chlamydospores if placed on pieces of sterilized chestnuts.

When germinated in beer-wort gelatine the mycelium produced the characteristic chlamydospores once more, but the submerged hyphæ, instead of remaining thread-like, became shortly septate, and some of the barrel-shaped cells so produced grew up into balloon-like structures, 100μ in diameter, whose walls either thickened considerably and became carbonized, or broke and set free what appear to be myriads of minute oil drops. The general appearance strongly suggested an attack by some fungus near the Chytridiaceæ, but subsequent investigation showed that this was not the case. The result is probably pathological, and determined by the amount of sugar present, for cultures of the fungus in 5 per cent. glucose, or cane sugar, give pure cultures of this form only.

When the chlamydospores were sown on a watery extract of chestnuts, made up with agar-agar, a further crop of chlamydospores were produced, and at the same time the submerged hyphæ gave rise to small bunches of flask-shaped swellings, in the tips of which small conidia were formed, and shot out every three or four hours. By keeping down the available food supply, by using very dilute watery extracts, the formation of the chlamydospores could be checked, and practically pure cultures of this peculiar conidial stage produced. Later on, particularly when the extract was not too dilute, these cultures gave rise to spore-balls so similar to those of *Urocystis violae*, that I could not find a single characteristic to separate them by. They contained a variable number of thick, brown-walled chlamydospores (1-6 as a rule), invested by a single layer of thin, almost colourless, envelope cells. A somewhat similar spore form was also found on examining the cultures on pieces of chestnuts. In these spore-balls the chlamydospores were far

more numerous, as many as twenty being not infrequently met with, and the envelope cells formed several layers. They occurred in fair abundance in the wet cotton-wool plugs supporting the pieces of chestnut, but they were only found once on the chestnut itself, and then in a cavity almost full of water.

On tracing their development in the chestnut cultures they were found to arise from hyphæ, at first similar to those which produced the chlamydospores described by Berkeley. Instead of cross septa being formed when the coil consisted of a single turn though, the hyphæ grew into helices with six or more turns, forming a structure identical with the ascogonium of an *Eurotium*. Then the upper turns put out a number of branches, which grew downwards, weaving in between one-another, and finally forming an investing case (Fig. 2). These enveloping hyphæ obscured any further changes going on in the original helix, so serial microtome preparations of these sporogenous bodies were made using material of various stages of growth. From these the details of development were readily traced. In the earlier stages the growth of the investing hyphæ pushed apart the coils of the helix to a certain extent. It then became shortly septate, some four to six septa being formed in each complete turn. The cells so formed increased in size rapidly, and acquired hard, brown, carbonized walls, which, owing to mutual pressure, were many-angled. At the same time, their cell contents became dense and full of deeply-staining granules. Meanwhile the contents of the investing hyphæ practically disappeared, while their walls became a pale translucent brown, so forming the envelope-case of the spore-ball (Fig. 3).

These spore-balls were then germinated on the media previously used, with the following results: — On pea extract the mycelium produced from each spore of the mass was sterile; on chestnut-agar endoconidia were produced, but not very abundantly; and on beer-wort gelatine the peculiar mycelium with short septa and strongly-swollen segments. These are precisely the same results as those obtained with the strikingly different spore form described first. Further, instead of producing the first form of chlamydospore, the chestnut-agar cultures gave rise to small spore-balls. The development of these was easily traced in hanging-drop cultures. A small helix of some two to four coils was first produced, from which very short hyphæ arose, which, instead of investing the coil by weaving together, remained closely adpressed to it, so forming an envelope layer of one cell in thickness. The coil then broke up into chlamydospores, in the fashion already described (Fig. 4).

From its mode of development, and from the fact that on germinating these smaller spore-balls, the results were identically the same as on germinating the larger ones, it was obvious that they were one and the same form, yet the morphological differences seemed great enough to almost warrant the supposition that they belonged to different genera of fungi. In the one case a single envelope layer enclosed from one to eight spores, in the other a many-layered envelope enclosed twenty or more. On casting round for an explanation of this fact, it was found that the differences were probably due solely to the amount of moisture present while the helices were developing. Where there was an excess of moisture, as in the case of those growing in the wet cotton-wool plugs, the large form was produced, while on the drier gelatine and agar-agar plates the smaller form only occurred. Further, by keeping the plate cultures very moist the short branches were induced to grow out into the long interweaving ones, and so to give rise to a many-layered envelope. Spore-balls, when half-developed, were transferred from these moist agar-chestnut cultures to other media, but beyond the investing hyphæ growing further to form fresh helices and spore-balls, nothing of interest was met with.

Here again, then, we have a case where simply changing one factor, namely, the rate of transpiration, produces differences in the spore form, great enough to lead one to suppose that one was dealing with two different species at least.

Since making these cultures I have found the small spore-balls in diseased chestnuts, though never associated with Berkeley's form. It must, therefore, be assumed that they are the normal form.

Besides producing the abnormal mycelium in beer-wort gelatine, the aerial hyphæ grew out into curious arches or spirals, which became shortly septate. Each segment then swelled out strongly, more particularly those towards the centre of the arch, and the walls became carbonized, so giving rise to structures very similar to the ascogonia (scolecites) described by Tulasne and Janczewski in the early stages of *Ascobolus* (Fig. 5). in spite of the carbonized walls these rows of cells were not spores, for no signs of germination could be obtained with them under any conditions, and certain facts seem to point to their further development along the lines of an Ascomycete. It is thus peculiarly interesting to note that one can determine solely by varying the food supply whether a helix producing chlamydospores, or this provisional scolecite, shall be raised. Moreover, if the young scolecite was transferred to agar-chestnut plates the fungus made the attempt to produce a spore-ball out of it by investing it with envelope branches. The attempt generally ended in failure, for single cells of the scolecite were often too big (70-80μ) to be readily invested.

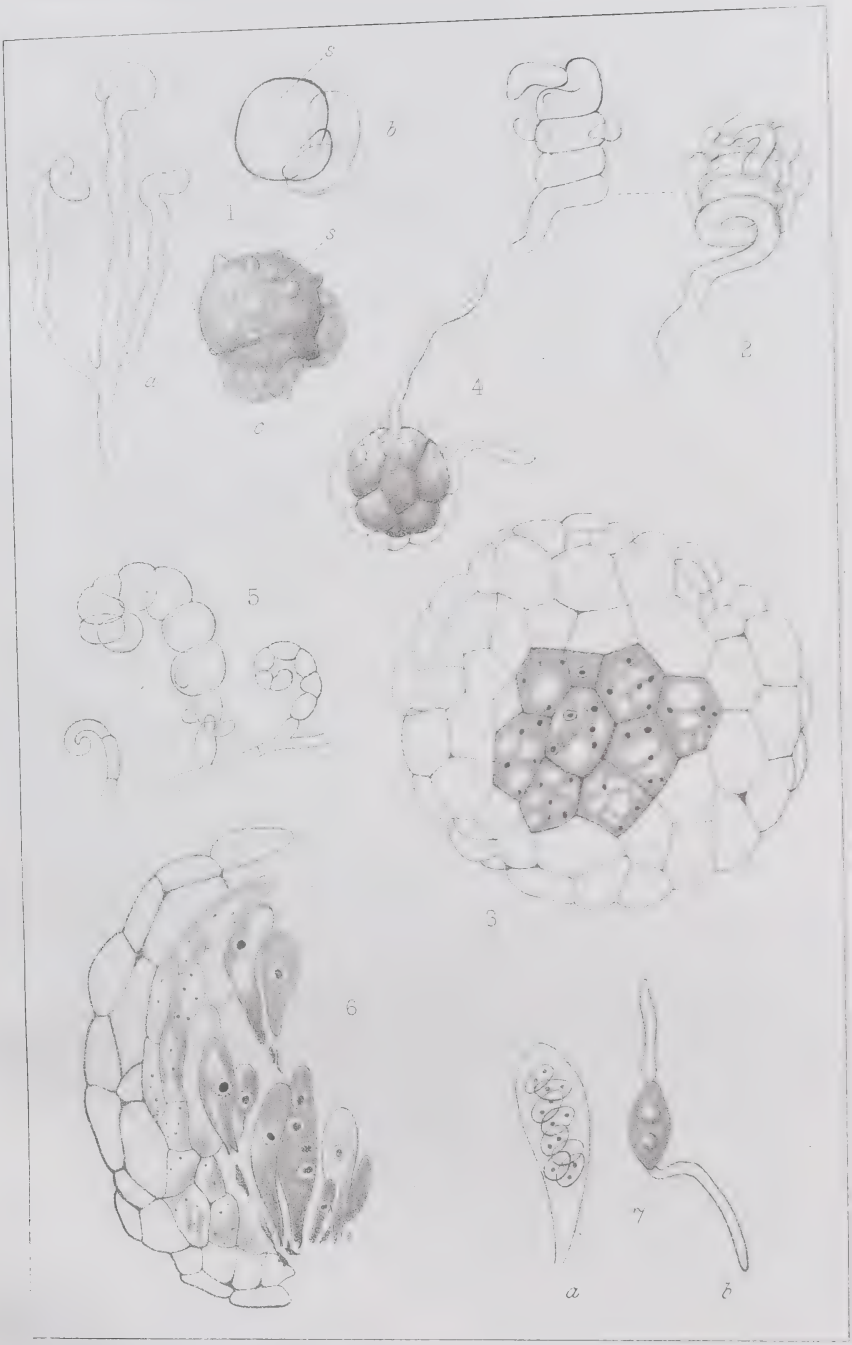
At this stage it seemed feasible that the fungus was really an Ascomycete, although the spore-balls pointed to its being a near relation of some Ustilago, such as *Urocystis*, or possibly *Geminella*. It appeared to grow too readily as a saprophyte to belong to such a typically parasitic group as the smuts, and, further, endoconidia are characteristically produced by the Ascomycetes only, while *Eurotium*-like and *Ascobolus*-like ascogonia were more than suggestive of the latter. Nevertheless, a long series of experiments, carried out on all the media and under all the conditions I could command, gave no further results, and, finally, I had to fall back on infection experiments with the living nuts. For this purpose, what appeared to be sound nuts were infected with chlamydospores, or with the spore-balls, after carefully sterilizing the outer skin with an alcoholic solution of corrosive sublimate. The wounds were then dressed with paraffin wax to stop the entry of any other fungi, and the nuts were stored in slightly-moistened sand. Under these conditions it was possible to obtain a number of pure cultures of the fungus, though some of the nuts were attacked by *Penicillium* and *Mucor*. The chlamydospore infections gave a crop of chlamydospores only, the spore-balls gave spore-balls and small reddish-brown, hard-walled perithecia. The walls of the perithecia were smooth and without bristles, and the ostiole was small, and flush with the surface, *i.e.*, not raised on a papilla or forming a neck. It contained no paraphyses, but numbers of broadly club-shaped asci, each with eight elliptical, dark-walled spores, slightly pointed at each extremity. The development of these perithecia proved very difficult to trace, and all of the details have not so far been clearly made out. Thus the origin of the ascogenous hyphæ is still undetermined with any degree of certainty, and I have to assume that they spring from the scolecite. In the earliest stages I have been able to obtain the whole of the perithecium was filled with a pseudo-parenchyma of hyphæ, richly stored with food materials. Midway between the apex and the centre this parenchyma broke down, forming a spherical cavity lined with delicate hyphæ, all pointing in an upward direction, which finally formed the lining of the ostiole. The whole mass of pseudo-parenchyma then became disintegrated, and a bunch of branching ascogenous hyphæ pushed their way from the base into the pulpy mass so formed (Fig. 6). The tip of each branch then bent over crosier-fashion and became septate at the apex, the penultimate cell of the group giving rise to an ascus after the method described by Dangeard. The broken-down parenchyma appeared to serve as food-material for the developing asci, which matured rapidly, and practically filled the whole of the perithecium. Hitherto lack of

material has prevented my following out the germination of these ascospores in detail, though I hope to be able to do so before long. To obtain them free from any adhering spore-balls the perithecia were well washed in sterilized water, and then crushed in beer-wort gelatine, from which drops were removed and mounted in cells for microscopic observation. In the course of twenty-four hours (16° C) the spores germinated and quickly formed a vigorous branching mycelium, the aerial portions of which produced numbers of spore-balls, and not, as I had expected, the chlamydospore form first described. This is the only set of germinations I have, so far, had the opportunity of making, and whilst it proves that the ascogenous stage really belongs to *Acrospeira*, it still leaves open the question as to how the presumed cycle of ascospore to chlamydospore is brought about. It seems probable, though, that further experiments under varying conditions of food supply will clear up this point also.

Berkeley's *Acrospeira mirabilis* thus turns out to be one stage in the life history of a Sphaeria, a group of fungi which, from the biological point of view, very little is known at present. A careful study of the life histories of some of the Dematieæ would, in all probability, show that many more of them are merely stages in the life-history of species belonging to this group. This work will, however, have to be carried out along the lines laid down once for all by de Bary—the story must be followed out in cultures from spore form to spore form, for the mere juxta-position of two different spore forms, even when repeatedly met with, cannot be taken as certain evidence that the two are stages in the life history of one and the same fungus. Thus in the case before us the mere fact that the perithecia occur with the spore balls is valueless unless the germination of the ascospore is taken into account, and although the spore-balls and simpler chlamydospores do not occur together in nature, their connection is better proved than that of the former spore forms, for it rests on identity of results on germinating under a variety of conditions.

EXPLANATION OF FIGURES.

1. (a) Earliest stage in the development of chlamydospores; (b) the curled apex is septate and the penultimate cell *s* is beginning to outgrow the others; (c) the ripe spore.
2. First stages in the development of the spore-ball from a culture on sterilized chestnut, showing the formation of the envelope layers.
3. A spore-ball, in section, from a chestnut culture, with a many-layered envelope and many spores.



R. H. Biffen del.

West, Newman lith.

Biffen.– On Acrospeira mirabilis, B & Br.

4. A spore-ball from a chestnut-agar culture, seen in optical section, with a single layer of envelope cells.
5. The "scolecite" stage from a spore-ball germinated in beer-wort gelatine.
6. Portion of a longitudinal section of an unripe perithecium, showing the young asci pushing through the disintegrated pseudo-parenchyma.
7. (a) An unripe ascus, and (b) an ascospore germinating in water after twenty-four hours.

NOTES ON A SPECIES OF STILBUM.

By Annie Lorrain Smith.

Stilbum tomentosum is a small white fungus with a fairly stout stalk, composed of hyphæ, which bear at the tips chains of spores, the whole forming a compact globose head. It grows on *Trichia* and some other Mycetozoa. The first account of the species is given with a rather indistinct figure in *Schrader's Journal für der Botanik* II., p. 65, published in 1799. The author so named it on account of a byssoid white tomentum from which the stalk emerged. He suggests that the plants figured by Bulliard, of *Mucor villosus*, Pl. 504, fig. 15, may be a young stage of the same fungus.

The next mention is by Persoon in 1801, in his *Synopsis Methodica Fungorum*, p. 680. He describes it as parasitic and with a tomentose stalk, but suggests that the byssoid tomentum may have developed in the process of drying. He thinks the name "*parasiticum*" would have been more adapted to the habit of the plant.

Persoon's suggestion is adopted by Ditmar, who figures and redescribes the fungus in Sturm's *Deutschland's Flora*, Heft. 3, p. 93, tab. 46. He calls it *S. parasiticum*, Pers., and says the stalk is glabrous but of a vesicular, floccose texture. He thinks that the felted mycelium noted by Schrader is some other white mould. He gives a characteristic figure of the plant, with the tiny globose spores.

In 1827 it was included by Greville in the British Flora. He records the finding of it by Berkeley in Glenfinlas. He goes

back to Schrader's name, even though he considers it inappropriate.

It has been found growing on *Trichia* in Europe, Ceylon, N. America, and Cuba. My interest in the fungus was aroused by the difference in the form and size of the spores, which puzzled me in my attempts to classify various specimens. The stalk I have always found to accord with Greville's description, "set with minute pellucid roundish processes." The spores in Greville's and Ditmar's figures are small round bodies. Saccardo describes them as "globosis exiguis," and Massee, in his Fungus Flora, adds the exact measurement as 2-3 μ in diameter. Specimens sent to me from Devonshire and Hampshire tally with the above descriptions: the stalks are beset with processes, the spores are globose, though smaller somewhat. They are extremely minute. I received still another specimen from Egham, in Surrey, which had a similar stalk, but the spores are oval in form and measure up to 5 μ by 2 μ. On examining *Stilbum tomentosum* in the National Herbarium at S. Kensington, I found a Ceylon specimen in the Broome collection, in which the spores have been drawn and measured by that careful worker; they are oval in form and ·0002in. long or 5 μ There are other specimens in the Broome herbarium collected in England, but the spores are not figured. The difference between the spores of the two kinds of *Stilbum* amounts almost to a specific distinction, but the plants are otherwise so much alike, that it seems better to distinguish the second as a variety. The form with globose spores has the priority; the other I propose to name var. *ovalisporum*.

LINDROTH'S CLASSIFICATION OF THE UREDINEÆ ON THE UMBELLIFERÆ.

By C. B. Plowright, M.D.

The recently published work of J. I. Lindroth, published at Helsingfors, *Die Umbelliferen-Uredineen*, consists of a classification and description of all the known species, some eighty-eight in number, of uredines which attack umbelliferous plants. It may not be uninteresting to see what would be the arrangement of our British species under this system.

The author divides the Pucciniæ on the Umbelliferæ—which are by far the most numerous—into four groups: (1) Those

with reticulate teleutospores; (2) with verrucose; (3) with smooth; (4) with well developed teleutospores thickened above, on coloured persistent stems; and (5) a group which includes four exotic Lepto-pucciniæ.

PUCCINIÆ.

I. RETICULATÆ.—Teleutospores with reticulated epispores.

1. Puccinia Smyrnii-olusatri, D.C.
   Spermogonia, Æcidia and teleutospores.
   On Smyrnium Olusatrum, L.

2. P. Chærophylli, Purt.
   Spermogonia, Æcidia, uredo and teleutospores.
   On Anthriscus sylvestris, Hoffm.
   Myrrhis Odorata, Scop.

3. P. Pimpinellæ, Strauss.
   Spermogonia, Æcidia, uredo and teleutospores.
   On Pimpinella Saxifraga, L.

4. P. Heraclei, Grev.
   Spermogonia, Æcidia, uredo and teleutospores.
   On Heracleum Sphondylium, L.

5. Puccinia bulbocastani, Cum.
   Spermogonia, Æcidia and teleutospores.
   On Carum Bulbocastanum, Koch.

6. P. Cicutæ, Lasch.
   Spermogonia, Æcidia, uredo and teleutospores.
   On Cicuta virosa, L.

II. PSORODERMÆ.

Epispore of the teleutospores verrucose.

7. P. Hydrocotyles, Link.
   Spermogonia, Æcidia, uredo and teleutospores.
   On Hydrocotyle vulgaris, L.

III. BULLATÆ.—Teleutospores smooth, uredospores distinctly thickened above.

8. P. Petroselini, D.C.
   Spermogonia, uredo and teleutospores.
   On Æthusa Cynapium, L.
   Carum Petroselinum Benth. and Hook. fil.

9. P. Conii, Strauss.
Uredo and teleutospores.
On Conium maculatum, L.

10. P. Angelicæ, Schum.
Spermogonia, primary uredo, secondary uredo, primary teleutospores and secondary teleutospores.
On Angelica sylvestris, L.

11. P. Apii, Desm.
Spermogonia, Æcidia, uredo and teleutospores.
On Apium graveolens, L.

12. P. bullata, Pers.
Spermogonia, primary uredo, secondary uredo, primary teleutospores, and secondary teleutospores.
On Silaus flavescens Bernh.

13. P. Ægopodii, Schum.
Uredo teleutospores.
On Ægopodium Podagraria, L.

14. P. tumida, Grev.
Teleutospores.
On Conopodium denudatum, Koch.

15. P. Saniculæ, Grev.
Spermogonia, Æcidia, uredo and teleutospores.
On Sanicula europæa, L.

16. P. Bupleuri-falcati, D.C.
Spermogonia, Æcidia, uredo and teleutospores.
On Bupleurum tenuissimum, L.

IV.—Teleutospores, long covered by the epidermis; on persistent coloured pedicels. No British species.

V.—No British species.

UROMYCES.

No British species.

HETEROECIOUS ÆCIDIA.

17. Pucinia Conopodii, Kleb.
Æcidia on Conopodium denudatum, Koch.
Teleutospores on Polygonum bistorta, L.

AGARIC TRANSFORMATIONS.

By M. C. Cooke.

It is still a problem whether—and to what extent—Hymenomycetal fungi may be modified in respect of their chemical constituents, by the soil in which they grow, or the circumstances by which they may be surrounded. There are a few pertinent facts, which have led me to the conclusion that close observation is necessary, and the record of illustrative phenomena would be useful, in determining whether Agarics, belonging morphologically to the same species, from which they do not appear to vary externally in the slightest appreciable degree, may not sometimes possess properties which prevent their use as articles of food, and at other times be perfectly harmless and edible. In point of fact, can we believe that an Agaric which normally is acrid, and injurious as an esculent, may be developed under other circumstances, with the same external features, but which is devoid of any acridity, and is mild and agreeable, and may be eaten with impunity. The question to be determined is, whether we are to regard these two forms as modifications of the same species, or whether the difference should constitute a specific distinction.

I may be permitted to illustrate my meaning by an appeal to examples. Most practical mycologists are aware that the typical form of *Russula rubra* (Cooke Handbook, No. 1,203) is intensely acrid, and is generally characterized as poisonous; whereas I have found, more than once, specimens which possess all the characters of the original species, except that they are mild to the taste, and may be eaten without inconvenience (compare "Illustrations" plate 1,025, and plate 1,087). The latter corresponds to the *Russula atropurpureus* of Krombholz (pl 64, figs. 5-6), and has been called by me *Russula rubra* var. *sapida*. Krombholz calls it "mild."

Another instance may be found in *Russula fœtens* (Cooke Handbk. No. 1,216), which, in its normal condition, is well known by its characteristic external features, as well as by its acrid taste, and repulsively fœtid odour. What are we to say of the specimens which I have met with, and submitted to the judgment of friends around me, which precisely resemble the typical species in everything else, but which possessed no acridity to the taste, and were not only quite free from any

fœtid odour, but, on the contrary, were pleasant and decidedly fragrant.

Again, what are we to say of the brown form of *Amanitopsis vaginata*, often met with in company with the grey form, the latter being in my experience exceedingly delicate in flavour, and was always eaten by myself, and my late friend, Dr. Wharton, with great appreciation. This testimony cannot be given by me in favour of the brown form, which, when tested on two or three occasions, caused unpleasant symptoms in the gastric regions, and has since been discarded from the table. On the contrary, a letter before me states "personally, I consider *A. vaginata* by far the most delicious of our esculent fungi, and we eat with impunity the fulvous form just as much as the grey form." Nevertheless Massee declares it to be "unpalatable," and several continental authorities call it "suspected" or "not esculent." At one time I contemplated, as a measure of precaution, to call the brown variety *Amanitopsis fulva*, as some continental mycologists have done, but fail to find any distinct morphological distinction, capable of diagnosis.

I need scarcely multiply examples, save to allude, in passing, to a variety of *Agaricus campestris*, which is sometimes found in pastures, with a dark brownish pileus, the eating of which has several times been communicated to me by correspondents, to have produced unpleasant results.

The suggestion which I would venture to offer, respecting these variations, is that some means should be taken, if possible, to ascertain whether the abnormal conditions found in these varieties can be attributed to any alteration in the chemical constituents of the soil in which they were found, or any external circumstances which could transform such susceptible cellular organisms as Agarics from acrid to mild, or vice versa.

In conclusion, I may remark, as a personal experience, that the specimens of *Psilocybe semi-lanceatus* sent to me for report, on two or three occasions, when children have been poisoned by eating them, have invariably belonged to the variety which I have called *cærulescens*, in which the base of the stem becomes of an indigo-blue colour. Can it be that this variety only is poisonous, and that it is indicated by the blue colour, and, moreover, that this coloration results from some unknown external conditions, which alter the chemical constituents of the fungus. These appear to me to be problems which are worthy of solution.

FUNGI NEW TO BRITAIN.

By Annie Lorrain Smith and Carleton Rea, B.C.L., M.A., &c.

Chrysophlyctis Schilb. Ber. d. Deut. Bot. Ges. XIV. 1896.

Sporangia thick-walled, golden brown, without mycelium, spherical, containing zoospores, occurring singly or a few together among the cells of the host plant.

C. endobiotica Schilb.

Occurring on the tubers and lower leaves of the Potato, causing gall-like outgrowths, the outer layers of the galls especially crammed with sporangia. The sporangia are thick-walled subspherical, varying in size, about 60-70 × 50μ. I have not succeeded in germinating these sporangia, the material I examined was sent in to the Royal Agricultural Society in August from N. Wales.

M. C. Potter describes the same disease sent to him from Cheshire in 1900. Journ. Board of Agric. IX. (1902), pp. 320-323, pl. 1.

There seems to be little doubt that it is the fungus described by Schilbersky, though no measurement or plates accompany his description.

Pythium ultimum Trow. Ann. Bot. XV. (1901), p. 300.

Hyphæ long, slender, much branched up to 1 c.m. in height and 6·5 to 1·7μ in width. Conidia chiefly terminal, spherical, varying from about 12 to 28μ in diameter, sometimes intercalary and barrel-shaped; oogonia terminal from 19·6 to 22·9μ in diameter, antheridia usually one to each oogonium, arising from the oogonial stalk, or in luxuriant cultures diclinous in origin; oospores one in each oogonium from 14·7 to 18·3μ in diameter, with a smooth, thick, yellowish epispore, germinating after a period of rest by one or more germ-tubes. Zoospores never developed.

Saprophytic on vegetable and animal substrata.

Syncephalis intermedia Van Tiegh. Ann. Sci. Nat., Ser. 6, Vol. I., p. 127, pl. 3.

On rabbit dung. Leith Hill, Surrey. Massee and Salmon. Ann. Bot. XVI. (1902), p. 77. figs. 23-26.

Circinella umbellata Van Tiegh and Le Mon. Ann. Sci. Nat., Ser. 5, Vol. XVII. (1873), p. 300, pl. 21, figs. 18-23.

On ostrich dung, and on cat dung, Kew. Mass. and Salm., l.c., p. 78.

Monilia candicans Sacc. Fung. novi vel. crit., No. 246.

Tufts floccose, from yellowish to white; sterile hyphæ creeping, fertile erect, sparingly septate, vaguely branched above, colourless; conidia catenulate, rising from small sterigmata on the branches, lemon-shaped, 15 × 9-10μ, subhyaline, faintly yellowish.

On rotten wood. Belmont, Hereford.

Monilia Koningi Oud. Arch. Neer. des Sci. Exact. et. Nat. VII. (1902), p. 287, Tab. 21.

Hyphæ colourless, 4-5μ thick, septate, creeping, dichotomously branched, fertile branches erect forming a raceme 30-40μ long, with a chain of up to 20 conidia at the tips; conidia subglobose apiculate, smooth 6-8μ in diameter, faint reddish-brown (avellaneo-roseis).

Grown in gelatine from pulverized humus, it forms orbicular, subzonate brownish tufts.

This is evidently the same fungus as one I grew several years ago on its natural matrix, decaying vegetation. In my specimen the fertile branches are nearly all subdivided into two or more of the fertile branchlets. If Oudemans' species were grown in more natural conditions the branching might be different. Some of his branches are divided as shown in the drawing.

Grown at South Kensington from material collected at Annan, Dumfriesshire.

Cephalosporium succineum. Mass. and Salm., l.c., p. 79, Fig. 34.

Forming very minute scattered patches on sheep's dung. Reigate.

Acremonium fimicolum. Mass. and Salm., l.c., p. 79, Fig. 92.

Forming snow-white tufts on rabbit dung. Kew.

Sepedonium niveum. Mass. and Salm., l.c., p. 80, Fig. 70.

On dung of red deer. Kew.

Oedocephalum ochraceum. Mass. and Salm., l.c., p. 80, Figs. 83-85.

On dung of rabbit. Kew.

Botrytis pilulifera Sacc. in Mich. II. (1880), p. 122.

Forming dense snow-white tufts on fowl's dung. Kew. Mass. and Salm., l.c., p. 81.

Botryosporium foecundissimum (Sacc. and March). Mass. and Salm., l.c., p. 81, Figs. 71-75.

On the dung of giraffe. Kew.

Aspergillus clavatus Desm. Ann. Sci. Nat., Ser. 2, Vol. II. (1834) p. 71.

On cardboard among dung. Kew. Massee and Salmon, l.c., p. 82.

A. niger Van Tiegh. Ann. Sci. Nat., Ser. 5, Vol. VIII., p. 240.

Sporophores often more than 1 mm. in length, 10-16μ thick, brownish, with a dark brown head of spores; spores globose 3·5-4·5μ in diameter, with more or less warted, violet-brown epispore.

On germinating seeds, Norwood, also on wax from the human ear, Kent.

This fungus seems to be unrecorded for Britain, though by no means rare. It has the branched sterigmata characteristic of *Sterigmatocystis*, but that genus has been sunk by recent systematists, who find that the branching is not constant even in one individual.

Rhizoctonia violacea Tul. Fungi Hypog., p. 188.

Underground sterile fungus investing tubers and roots with a dense violet mycelium, hyphæ branched, septate up to 10μ in width.

On mangolds sent to the Roy. Agri. Soc.

The mangold attached was kept in moist condition for some time, but no fruit was formed. The mycelial form is well-known on the Continent and in America. The life-history is not known.

Arthrobotrys superba Corda. Prachtfl., p. 43, pl. 21 (1839).

On dung of goat, Kew. On horse dung, Epping Forest. Mass. and Salmon, l.c., p. 83.

Trichothecium inaequale Mass. and Salm., l.c., p. 84, fig. 61.

On horse dung, Reigate. On rabbit dung, Kew. Forming a delicate effused bloom.

Trichosporium insigne Mass. and Salm., l.c., p. 85, fig. 33.

On pigeon dung, Kew.

Trichocladium asperum Harz. Bull. Soc. Imp. Nat., Moscow, XLIV. (1871), p. 125, Tab. 2. f. 1.

On rabbit dung, Kew.

Cercospora Melonis Cke. Journ. Board of Agric., IX., 1902, pp. 196-198, pl. 1.

On diseased cucumber leaves, sent to Kew for determination.

Sporodesmium piriforme Corda Icon. Fung. 1 (1837), p. 7, f. 116.

On rabbit dung, Mulgrave Woods, Yorkshire. Mass. and Salmon, l.c., p. 85.

Stysanus fimetarius (Karst.) Mass. and Salm., l.c., p. 86, fig. 62.

On the dung of Sinaitic Ibex and common camel. Kew.
On decaying vegetation. Belmont, Hereford.

The authors have given this fungus, described by Karsten as a variety of S. *Stemonitis*, specific rank. The specimen collected at Hereford shews exactly the same characters, rather blunt, dark-coloured spores, with very distinct warts. It is very different from *S. Stemonitis*.

Chaetostroma fimicolum Mass. and Salm., l.c., p. 87, figs. 67-68.

On rabbit dung. Reigate.

Graphium Comatrichoides Mass. and Salm., l.c., p. 88, figs. 89-91.

On dung of llama. Kew.

Gymnodochium fimicolum Mass. and Salm. (g. et sp. nov.), l.c., p. 89, figs. 49-51.

On dung of Ural wild sheep. Kew.

Ascodesmis Volutelloides Mass. and Salm., l.c., p. 61, figs. 13-17.

On dung of kangaroo. Kew.

Arachniotus citrinus Mass. and Salm., l.c., p. 62, figs. 86-88.

On dung of kangaroo. Kew.

A. candidus Schroet. in Cohn's Krypt. Fl. Schles. Bd. III., Haefte 2, (1893), p. 210.

On an old nest of a wild-bee and on the dung of the common roe. Kew. Mass. and Salm., l.c., p. 62.

Gymnoascus setosus Eidam, in Bot. Centralbl. X. (1882), p. 107.

On an old nest of a wild-bee. Kew. Mass. and Salm., l.c., p. 63.

Myxotrichum aeruginosum Mont. Ann. Sci. Nat., Ser. 2, Vol. VI. (1836), p. 34.

Syn. *M. ochraceum* B. and Br. Ann. and Mag. Nat. Hist., Ser. 4, Vol. XV. (1875), p. 37, No. 1475, pl. 1, f. 4. Mass. and Salm., l.c., p. 65, figs. 76-79.

M. spinosum Mass. and Salm., l.c., p. 64, figs. 63-66.

On dead branches of *Fraxinus*.

Ombrophila decolorans (Berk. and Curt.). Grevillea IV. (1876), p. 6. Redescribed by Massee. Trans. Linn. Soc. XXXI., pp. 466-7, pl. 18, figs. 23-4.

On decaying stump, Yorkshire. Crossland. Nat., Jan. 1902, p. 30.

Mollisia amenticola (Sacc.). Rehm, Rabh. Krypt. Flo. Disc., p. 540.

Apothecia gregarious, sessile, globose, then somewhat flat, the disc whitish yellow, brownish outside, becoming darker yellow when dry $\frac{2}{10}$-1 mm., soft and waxy; asci clavate-cylindrical, round above, 45-55 × 4-5μ, 8-spored; spores cylindrical obtuse, straight or slightly bent, one-celled 6-8 × 2-2·5μ colourless, bi-seriate; paraphyses thread-like; cells of the cup large and parenchymatous, yellowish, almost colourless towards the edge.

On female catkins of *Alnus glutinosa*. Yorkshire. Crossland. Nat., Jan. 1902, p. 29.

Sclerotinia Fuckeliana Fuck. Sym. Myc., p. 330.

Apothecia mostly solitary, growing from a finely warted sclerotium, 2-4 mm. long by 1-2·5mm. broad; disc at first globose and closed, then cup-shaped, becoming flat, with a delicate edge; the stalk cylindrical, straight or bent 2-10 mm. long by 1 mm. thick, smooth, brownish; asci cylindrical, rounded above, 100-120 × 9-12μ, 8-spored; spores elongate-elliptical, blunt, one-celled, guttulate, colourless, 9-11 × 5-6μ, paraphyses thread-like, septate, 5μ broad, colourless; tissue pro-senchymatous, faintly brown.

On leaves of vine—causing disease.

Grown from sclerotia that were causing a disease on the stems of gooseberry bushes. Hereford.

Anixiopsis stercoraria Hans. Bot. Zeit. LV. (1897), p. 131, Taf. 11, fig. 8.

On owl castings, Kew. Mass. and Salm., l.c., p. 67, figs. 27-28.

Arachnomyces nitidus Mass. and Salm. (g. et sp. nov.), l.c., p. 68, figs. 127-131.

On decaying vegetation, Kew; Yorkshire, C. Crossland.

On dung of rat, Cheshire.

A. sulphureus Mass. and Salm., l.c., p. 68, figs. 55-60.

On an old nest of a wild-bee. Kew.

Magnusia nitida Sacc. Mich. I. (1878), p. 123. Mass. and Salm., l.c., p. 69, figs. 1-5.

On dung of Sinaitic Ibex. On rabbit dung, Reigate.

Chaetomium simile Mass and Salm., l.c., p. 71, figs. 8, 9.

On dog's dung, Kew.

C. crispatum Fuck. Sym. Myc., p. 90.

Perithecia gregarious, broadly elliptical about $\frac{1}{2}$ mm. in height; terminal hairs of two kinds, awl-shaped straight or slightly wavy, septate hyaline-brown; or of a cork-screw form, dark brown or almost black, and rough; asci cylindrical, shortly stalked, about $100 \times 10\mu$, 8-spored; spores broadly elliptical, pointed at both ends $12 \times 10\mu$, olive-brown.

On decaying hyacinth bulbs. Norwood.

C. hostrychoides Zopf. Sitzungsber. Bot. Ver. Brandenb. XIX. (1877), p. 173.

On dung of giraffe, burrhel wild sheep and mouse, Kew. Mass. and Salmon, l.c., p. 72. figs. 6, 7.

Sordaria bombardioides Auersw. Niessl. Beitr. zur Kenntniss der Pilze (1872), p. 37, Tab. VI., fig. 4.

On dung of llama, Kew. Mass and Salm., l.c., p. 73.

Delitschia insignis Mouton. Compt. rend. Bull. Soc. Roy. Bot. Belg. XXXVI. (1897), 2 part, p. 13, t. A., f. 8.

Perithecia globose, immersed, smooth, coriaceous $\frac{1}{2}$–$\frac{2}{3}$ mm. in diameter, ostiole rather long and stout, asci fusoid cylindrical, pedicellate, sporiferous parts $180\text{-}200\mu \times 30\mu$, stalks $30\text{-}50\mu$ long, paraphyses filiform, septate, longer than the asci; spores bi-seriate, oblong, round and obtuse at the apex, brown, constricted, 1-septate, the lower parts sometimes faintly septate, without a zone of mucous but bearing a fine hyaline appendage $40\text{-}60 \times 15\mu$.

On horse dung. E. S. Salmon, Epping Forest. Found originally on cow dung. Mass. & Salm. Ann. Bot. vol. XV., p. 344.

Fuligo ochracea Peck. Lister's Mon. Mycetozoa, p. 67.

On the stem of a withered plant of Pteris aquilina, The Horner Valley, Porlock, Somerset, 8th Nov., 1901, Mrs. A. Montague. This Myxomycete has only been found once before in Britain, viz.: at Aran Mawddwy, Merionethshire (see Journ. Bot. 1901, p. 84).

Amanita citrina Gonn. and Rab., Myc. Eur. (1869), t. 4.

On the bank of a stream, Epping Forest. George Massee. Essex Naturalist, 1902.

Lepiota clypeolaria Bull. var *alba* Bres. Fung. Trid., Vol. I., p. 15, pl. XVI.

Pileus 3-7 cm. broad, fleshy, convex, then expanded, broadly umbonate, silky; margin fibrillously flocculose, then squamulose; glabrous at the centre and becoming yellowish with age. Gills free, crowded 5-7 mm. broad, white then ochraceous. Stem 4-6 cm. long by 8-10 mm. thick; white, somewhat fuscous at the base, hollow, equal or attenuated downwards, white floccose and spotted yellow below the ring and often forming a spurious second ring, ultimately becoming glabrous. Ring distant, fugacious, white, floccose, submembranaceous, reflexed, striate above, yellowish floccose below. Flesh white, that of the stem somewhat yellowish. Spores obovate-oblong, rounded at the one end, apiculate at the other, one guttulate, white, hyaline $11\text{-}14 \times 6\text{-}7\mu$. Edible.

On the ground, Norfolk. Dr. C. B. Plowright, 26th October, 1902. Castle Rising Heath.

Schulzeria grangei Eyre.

Pileus 1-1½ inches broad, dark green, cracking into fibrous scales on a white ground, flatly umbonate. Stem caespitose, squamose, squamules tipped with the same colour as the pileus. Gills widest in front, minutely denticulate. Spores club-shaped $11 \times 5\mu$.

On soil among beech leaves, Nov. 1902. Swarraton, Rectory Wood, a parish on the estate of Lord Ashburton, The Grange, Hants. It comes next after *S. squamigera* Schulz. and Bres.

Inocybe Godeyi Gillet. Hym. de Fr., p. 517 (1874).

Yorkshire. Naturalist, Nov. 1902, p. 356.

Pholiota grandis Rea.

Pileus 20-30 cm. broad, fulvous tawny, convex then expanded and broadly gibbous, dry, covered with innate deep tawny squamules at the circumference which become revolute at the disc; flesh light yellow, 5 cm. thick at the centre. Stem 25-30 cm. long by 6-7 cm. thick, solid, fusiform, slightly squamulose and *tawny* below the ring, *deeply striate* for 5 cm. above. Ring distant, *almost fugacious*. Flesh *ferruginous*, light yellow at the apex and scissile in the centre. Gills *very broad* 1·5-2 cm. wide, attenuated in front, deeply *sinuato decurrent* behind, pallid then fuscous, somewhat crowded. Spores fuscous, oblong $6 \times 3\mu$. Odour and taste very pleasant. Caespitose at the

base of an ash, St. John's, Worcester, 30th Oct., 1901. Mr. Carleton Rea. Intermediate in character between *P. squarrosa* and *P. spectabilis*, from which it is distinguished by its very large size which is always constant, by the scales of the pileus being less squarrose than the former but much more revolute than the latter, by the flesh of the stem being ferruginous, by the deeply striate apex of the stem and the tawny colour of the base, by the very broad sinuato-decurrent gills, by the almost fugacious ring, and by the size and shape of the spores. I have observed this species at Murthley Castle, Killerton, near Exeter, and other stations.

Galera spicula Lasch, n. 580. Fr. Hym. Eur., p. 268.

Pileus membranaceous, 5-15 mm. across, conico-campanulate then expanded, brown ochre, smooth, hygrophanous, striate when moist, flocculose when dry and atomate. Stem 2-3 cm. high by 2-3 mm. thick, hollow, thickened at the base, firm, white and *densely covered with white flocci*. Gills adnate, ventricose 1·5-2 mm. wide, ochraceous then cinnamon. Spores 6-8 × 4μ smooth, cinnamon.

On cocoa-nut fibre. Oakden, Kidderminster, 22nd Nov., 1902. Mr. D. P. Goodwin.

Easily distinguished from its allies by its smaller size and white floccose stem.

Coprinus Bresadolæ Schulz. Hedwigia Vol. 24 (1885), p. 136.

Yorkshire. Naturalist, Nov., 1902, p. 355.

Coprinus velox Godey. Gilléts Champ. France. Hym., p. 614, with fig.

On horse dung, Kew. Massee and Salmon, l.c., p. 61.

Hygrophorous bicolor B. & Br. Jour. Linn. Soc. XI. p. 565.

Yorkshire. Naturalist, Nov., 1902, p. 356.

Merulius Guillemoti Boud. Bull. Soc. Myc. de Fr., Vol. X., p. 63.

Pileus 18 cm. wide, 9 cm. deep, and 4-5 cm. thick, white, dimidiate, imbricated, smooth, becoming greyish with age. Flesh cinereous white, with fuscous zones. Hymenium gyrose, subgelatinous, fulvous, pulverulent with the spores. Spores oblong-ovate, ferruginous, 2-3 guttulate 10-11 × 5-6μ.

On a post of stand, Cricket Ground, Worcester, 6th June, 1902. Mr. Carleton Rea.

It is probable that this species has been overlooked and has been referred to *lachrymans*; it, however, is distinguished from the latter by the thick, well developed imbricate and dimidiate pileus, and by the larger spores containing 2-3 guttæ.

Clavaria subtilis Pers. Comm. t. 4, f. 2, Fr. Hym. Eur., p. 669.

Tough, thin, white, becoming yellowish, glabrous at the base, *of equal thickness throughout* (1 mm.), branches *few*, *dichotomously forked* and somewhat fastigiate. Spores white, elliptical $6 \times 3\mu$. The whole plant is 2-2½ cm. high.

Amongst grass, Moseley Green, Forest of Dean, 16th Sept., 1902. Mr. Carleton Rea. Distinguished from allied species by its small size, equality of thickness, toughness and few branches.

Clavaria Michelii Rea=Clavaria fragilis Holmsk. var. C. gracilis Pers. Fr. Hym. Eur., p. 675.

Fasciculate, very fragile, *thin*, *cylindrical*, yellow, white at the base, clubs 4-7 cm. high by 1-2 mm. thick, hollow, apex *acute*, spores white *subglobose* $3 \times 2\mu$.

On the ground under a cherry tree, Dinmore, 23rd Sept., 1902. Mr. Carleton Rea. Distinguished from C. fragilis by its thin cylindrical acute clubs and subglobose spores.

Clavaria striata Pers. Ic. et desc., t. 3, f. 5. Fr. Hym. Eur., p. 675.

Caespitose, *subfuliginous*. Clubs 3-5 cm. high by 3-4 mm. wide, attenuated at apex and base, extreme base white, somewhat twisted and *here and there striate*, compressed, stuffed white inside, then hollow. Spores white, subglobose and apiculate $3\text{-}4 \times 2\text{-}3\mu$.

Amongst grass, near Beeches, Forest of Dean, 16th Sept., 1902. Mrs. Carleton Rea. Distinguished by its subfuliginous colour and striate club.

Stereum quercinum Potter. Trans. English Arboricultural Socy., 1901-1902, p. 7.

Patches small, irregularly shaped, from $\frac{3}{16}$ of an inch in diameter, to ¾ of an inch long by ½ an inch wide, resupinate, coriaceous, and inconspicuous, fitting in between the crevices of the bark to which they are closely applied, and concave, with slightly raised edge, pale grey to pale brown, often with a lighter margin. Spores colourless, elliptical, with rounded ends, $8{\cdot}5 \times 4{\cdot}3\mu$.

On oak, Gosforth Park, near Newcastle-upon-Tyne, 7th Jan., 1899.

Lycoperdon velatum Vitt., t. 2, f. 3.

Pyriform or subglobose slightly umbonate, 7 cm. high by 4½ cm. wide, and with white cord-like mycelium at the base. The outer layer of the peridium tomentose, snow-white, breaking up into evanescent *star-shaped rosettes* and forming a false ring-like appearance at the apex of the sterile basal stratum, finally disappearing almost

completely. The inner layer of the peridium white, then of a *delicate flesh colour* and finally *greyish*, furfuraceous and furnished with very thin and short spines. Gleba white, then fulvous, and finally ash coloured. Sterile basal stratum white. Spores warted, globose 4-5μ yellow, threads of the capillitium 3-4μ thick.

Amongst leaves, Aldenham, Salop, 25th Oct., 1902. Mr. Carleton Rea. Distinguished from all the other British Lycoperdons by the outer layer of the peridium being as it were a universal veil, and by the delicate maiden's blush colour of the inner layer of the peridium when fresh.

Published 2nd March, 1903.

THE SAVERNAKE FOREST FORAY.

5th to 10th Oct., 1903.

The seventh annual week's Fungus Foray was held in Savernake Forest and the Ailesbury Arms Hotel, Marlborough was constituted the headquarters for the meeting. Here the members assembled on Monday the 5th of October, and in the evening in a spacious room that had been secured in the Hotel for the exclusive use of the members, some interesting specimens were already set out on exhibition on the plates. The President the Rev. W. L. W. Eyre, brought from Swarraton, some nice examples of *Lepiota lenticularis* (Lasch) which Fries erroneously places in the Amanitae and *Lycoperdon velatum* Vitt.,* sent a few days earlier to the Secretary. Mr. W. B. Allen exhibited from the neighbourhood of Broseley, *Lepiota carcharias* Pers., *L.acutesquamosa* Weinm., *Inocybe obscura* Pers., *Boletus variegatus* Swartz. *B. versipellis* Fr., and *Geaster rufescens* Pers., and from Wyre Forest *Trametes Bulliardi* Fr. and *Tremellodon gelatinosum* Scop., and Mrs. Carleton Rea placed on the plates from the vicinity of Perth, *Armillaria bulbigera* A. & S., *Pholiota aurea* Mattusch., *Inocybe lateritia* Weinm, *Trametes mollis* (Sommerf.), *Sparassis crispa* Fr., *Clavaria Ardenia* Sow., *Cordyceps ophioglossoides* Fr., parasitic on *Elaphomyces variegatus* Vitt. and a mycetozoon that Mr. Arthur Lister next day identified as *Lepidoderma tigrinum* Rost.

On Tuesday, the 6th of October, a start was made from the Headquarters at 10 a.m. punctually, the members walking via the old Roman station of Cunetio into Savernake Forest, where they searched the portion that lies adjacent to the road that leads to the village of Savernake. Here they were rewarded with several interesting finds including *Pilacre faginea* B. & Br., *Hygrophorus metapodius* Fr., *H. fusco-albus* Fr., *Pholiota adiposa* Fr., *Cortinarius (Phlegmacium) emollitus* Fr., and *cristallinus* Fr., *Clavaria Krombholzii* Fr., *C. Kunzei* Fr., *C. luteoalba* Rea,† and a large patch some 18 inches or more across of the mycetozoon *Stemonitis fusca* Roth., var. *confluens* Lister. At the evening meeting, the Hon. Secretary had much pleasure in informing the members that he had now closed the list of foundation members, and that about seventy members still remained on the active list. Since his last report seventeen new members had joined the

* For description see Trans. Brit. Myc. Socy. vol. ii., p. 39, and Pl. 3 hereof.

† See p. 66, and Pl. 3.

Society, namely,— W. B. Allen, Benthall, Broseley; F. J. F. Barrington, Chapel Street, Kings Lynn; J. B. Carruthers, B. A. Government Mycologist and Assistant Director, Royal Botanic Gardens, Peradeniya, Ceylon; James Renny, Chepstow House, Southfields, London, S.W.; D. P. Goodwin, Oakden, Kidderminster; F. J. Rayner, Ivy Bank, Highfield, Southampton; Arthur D. Cotton, F. L. S., 33 Lowndes Street, London, S.W.; Alfred Adams M. A., M. B., Bridgend House, West Looe, Cornwall; Mrs. J. B. Robinson, Saint Mary's Lane, Louth; Mrs. Eliza A. Amphlett, Dalehurst, Bardwell Road, Oxford; Miss M. Claridge, 8 Park Terrace, Oxford; Arthur Lister, F. R. S., and Miss Gulielma Lister, Leytonstone; Miss May Grafton, Stoke Prior; James Clarke, Chapel House, Paisley; Miss Mary Miles, L. L. A., Laurel Bank, Bridgend, Perth; and Angus Grant, Drumälan, Drumnadrochit. They had to deplore the death of Mr. J. B. Robinson, who had done so much to elucidate the fungi in the neighbourhood of Louth, and he had also to report with regret the resignation of Professor F. W. Oliver, M. A., D. Sc. of University College, London. The Hon. Treasurer reported that the sum of £26 9s. 1d. was at that time standing to their credit at the Post Office, but from that must be deducted the cost of the programme of the present meeting £1, the hire of plates and room for exhibition of the fungi collected, and also the sum of fifteen shillings which had been received for subscriptions for the season 1904. The President then strongly pointed out the necessity of still contributing to the printing fund, and most kindly undertook, as his contribution thereto, to pay for one coloured plate* in the present number of the Transactions. The election of officers for the ensuing year was then proceeded with, Mr. Worthington G. Smith, F. L. S. was unanimously elected President; Professor H. Marshall Ward, D. Sc., F. R. S., &c., Vice-President; and Mr. Carleton Rea, B. C. L., M.A., Hon. Secretary and Treasurer. An invitation from the Committee of "The Haslemere Microscope and Natural History Society," to hold our annual foray for the season 1905, at Haslemere and Hindhead, was unanimously accepted. The members then considered several suggestions for the place of meeting next year, and as there was a general feeling that the convenience of our Northern members should be considered, it was unanimously resolved to fix upon Whitby as the centre, and to work the Mulgrave and Arncliffe woods from the 12th to the 19th of September 1904.

On Wednesday the 7th of October, the members were busy during the forenoon in determining the species collected on the previous day, and in placing the same on exhibition. A start was made about mid-day, the members proceeding along the Hungerford Road, and working that side of the Forest and on to a fir-plantation, where

* See Pl. v. and for description of Schulzeria Grangei Eyre, Trans. Brit. Myc. Socy. vol. ii. p. 37.

failing light compelled the members to desist from further search. The most interesting specimens collected included, *Lycoperdon velatum* Vitt., *Boletus pruinatus* Fr., *Lepiota seminuda* Lasch., *Mycena zephira* Fr., *Cortinarius (Phlegmacium) triumphans* Fr., *Eccilia carneogrisea* B. and Br., *Hygrophorus subradiatus* Fr. var. *lacmus* Fr., *Clavaria fumosa* Pers., *Tremellodon gelatinosum* Pers., and a mild tasting specimen of *Lactarius capsicum* Schulz. In the evening at the headquarters, Miss A. Lorrain Smith read an interesting note, on "*Gloeosporium Tiliae* a Disease of Lime Leaves" (see p. 55), and Mr. Carleton Rea, B.C.L., M. A., gave a paper entitled, "Notes on two Phalloideae new to Europe" (see p. 57).

On Thursday the 8th of October the members devoted the morning to investigating the previous days material, and then booked by the 1-30 train to Savernake Station. A few minutes walk soon brought them into the forest, and a traverse was then made via the Ailesbury Column and the Grand Avenue of beeches back to Marlborough. Great numbers of *Geoglossa* were noted as on the previous day, and a fair number of *Geaster fimbriatus* Fr. were collected, whilst the beeches throughout the forest were covered with large numbers of the destructive parasites, *Armillaria mucida* Schrad., *Pholiota adiposa* Fr. and *Pholiota squarrosa* Müll. The other specimens worthy of notice, included *Collybia hariolorum* D. C., *Collybia vertirugis* Cke., *Mycena elegans* Pers. and *Hydnum nodulosum* Fr. In the evening the Society's dinner was held at the Headquarters, and afterwards the President the Rev. W. L. W. Erye, delivered his address, entitled "Mycology as an instrument of recreation" (see p. 49). A hearty vote of thanks was then unanimously accorded to the Marquess of Ailesbury for his kind permission to visit Savernake Forest, and the Hon. Secretary was further directed to send to him a copy of their next Transactions, recording the result of the week's investigation.

On Friday the 9th of October the members drove from the Headquarters at mid-day, to the fir-plantation which had been only partially investigated on the Wednesday afternoon. Here Miss Gulielma Lister secured the somewhat rare mycetozoon *Licea flexuosa* Pers., and in the adjacent Forest, specimens of *Mycena rorida* Fr., *Eccilia griseorubella* Lasch., *Inocybe brunnea* Quél., *Naucoria scolecina* Fr. and *Merulius molluscus* Fr. were found. The return walk was then made to Marlborough by the principal entrance, some of the members taking advantage of Mr. J. W. Brooke's kind invitation to visit his very interesting private museum of Local antiquities on the way. Most of the members left Marlborough early on Saturday, the 10th of October, but one member added *Hygrophorus calyptraeformis* B. and Br. to the list before his departure. Over 450 species were collected during the foray, and Miss A. Lorrain Smith added a new North American mould *Helicomyces scandens* Morg. to the British Fungus Flora.

Complete List of Fungi gathered during the Foray.

Amanita mappa Fr., muscaria L., rubescens Pers.

Amanitopsis vaginata Bull., adnata W. G. Smith=junquillea Quél.

Lepiota procera Scop., rachodes Vitt., excoriata Schaeff., clypeolaria Bull., and var. pratensis Bull., cristata A. & S., erminea Fr., granulosa Bull., amianthina Scop., seminuda Lasch.

Armillaria mellea Fl. Dan., mucida Schrad.

Tricholoma sejunctum Sow., resplendens Fr., flavobrunneum Fr., albobrunneum Pers., rutilans Schaeff., terreum Schaeff., var. argyraceum Bull., saponaceum Fr., cuneifolium Fr., var. cinereorimosum Batsch., virgatum Fr., sulphureum Bull., album Schaeff., nudum Bull., panaeolum Fr., melaleucum Pers., var. polioleucum Fr.

Clitocybe nebularis Batsch., clavipes Pers., rivulosa Pers., cerussata Fr., phyllophila Fr., candicans Pers., maxima Fl. Wett., infundibuliformis Schaeff., geotropa Bull., inversa Scop., var. flaccida Sow., var. lobata Sow. metachroa Fr., ditopoda Fr., fragrans Sow.

Laccaria laccata Scop., var, amethystina Bolt., var. tortilis Bolt.

Collybia radicata Rehl., fusipes Bull., maculata A. & S., butyracea Bull., velutipes Curt., vertirugis Cke., stipitaria Fr., hariolorum D.C., confluens Pers., conigena Pers., tuberosa Bull., dryophila Bull., rancida Fr.

Mycena Iris Berk., elegans Pers., pura Pers., zephira Fr., lineata Bull., luteoalba Bolt., flavo-alba Fr., lactea Pers., rugosa Fr., galericulata Scop., polygramma Bull., alkalina Fr., ammoniaca Fr., peltata Fr., filopes Bull., sanguinolenta A. & S., galopoda Pers., epipterygia Scop., vulgaris Pers., rorida Fr., discopoda Lev., corticola Schum., capillaris Schum.

Omphalia pyxidata Bull., rustica Fr., fibula Bull., var. Swartzii Fr., integrella Pers.

Pleurotus dryinus Pers., ostreatus Jacq. var. columbinus Quél., applicatus Batsch.

Pluteus cervinus Schaeff.

Entoloma sinuatum Fr., lividum Bull., jubatum Fr., sericellum Fr., clypeatum Linn., costatum Fr., sericeum Bull., niderosum Fr.

Clitopilus prunulus Scop.

Leptonia lampropoda Fr., incana Fr.

Nolanea pascua Pers., mammosa Linn., pisciodora Ces., infula Fr.
Eccilia carneo-grisea B. & Br., griseo-rubella Lasch.
Claudopus variabilis Pers.
Pholiota squarrosa Müll., spectabilis Fr., adiposa Fr., mutabilis Schaeff., marginata Batsch.
Inocybe lanuginosa Bull., cincinnata Fr., pyriodora Pers., rimosa Bull., brunnea Quél., asterospora Quél., geophylla Sow.
Hebeloma fastibile Fr., glutinosum Lind., mesophaeum Fr., crustuliniforme Bull., var. minor Cke.=hiemale Bres.
Flammula carbonaria Fr., flavida Schaeff., inopoda Fr., sapinea Fr.
Naucoria melinoides Fr., scolecina Fr.
Galera tenera Schaeff., hypnorum Batsch.
Tubaria furfuracea Pers., crobula Fr.
Crepidotus mollis Schaeff.
Agaricus arvensis Schaeff., xanthodermus Gen., campestris Linn., silvicola Vitt., haemorrhoidarius Kalch.
Stropharia aeruginosa Curt., albo-cyanea Desm., inuncta Fr., merdaria Fr., semiglobata Batsch.
Hypholoma sublateritium Schaeff., capnoides Fr., fasciculare Huds., pyrotrichum Holmsk., velutinum Pers., appendiculatum Bull., hydrophilum Bull.
Psilocybe bullacea Bull., physaloides Bull., semilanceata Fr., foenisecii Pers.
Psathyra corrugis Pers., fibrillosa Pers.
Anellaria separata (Linn.).
Panaeolus phalaenarum Fr., campanulatus Linn.
Psathyrella gracilis Fr., atomata Fr., disseminata Fr.
Coprinus comatus Fr., atramentarius Fr., niveus Fr., micaceus Fr., lagopus Fr., radiatus Fr., ephemerus Fr., plicatilis Fr.
Bolbitius fragilis Fr.
Cortinarius (Phlegmacium) triumphans Fr., largus Fr., scaurus Fr., emollitus Fr., cristallinus Fr.
(Myxacium) elatior Fr., livido-ochraceus Berk., pluvius Fr.
(Inoloma) pholideus Fr.
(Dermocybe) caninus Fr., anomalus Fr., cinnamomeus Fr. and var. croceus Fr. and var. semisanguineus Fr.
(Telamonia) hinnuleus Fr., brunneus Fr., psammocephalus Fr., incisus Fr., iliopodius Fr., hemitrichus Fr., paleaceus Fr.
(Hygrocybe) subferrugineus Fr., castaneus Fr., leucopus Fr., erythrinus Fr., decipiens Fr., acutus Fr.
Gomphidius glutinosus Fr., viscidus Fr.

Paxillus involutus Fr.

Hygrophorus fusco-albus Fr., pratensis Fr., virgineus Fr., and var. roseipes Mass., niveus Fr., russo-coriaceus B. & Br., metapodius Fr., subradiatus Fr. var. lacmus Fr., laetus Fr., ceraceus Fr., coccineus Fr., miniatus Fr., puniceus Fr., obrusseus Fr., conicus Fr., calyptraeformis B. & Br., chlorophanus Fr., psittacinus Fr., unguinosus Fr., nitratus Fr.

Lactarius torminosus Fr., turpis Fr., pubescens Fr., insulsus Fr., blennius Fr., chrysorheus Fr., capsicum Schulz., vellereus Fr., deliciosus Fr., pallidus Fr., quietus Fr., aurantiacus Fl.D., rufus Fr., glyciosmus Fr., fuliginosus Fr., serifluus Fr., mitissimus Fr., subdulcis Fr.

Russula nigricans Fr., adusta Fr., chloroides (Kromb) Bres., furcata Fr., depallens Fr., lepida Fr., vesca Fr., cyanoxantha Fr., foetens Fr., fellea Fr., emetica Fr., ochroleuca Fr., fragilis Fr., var. nivea Cke., var violacea Quél., integra Fr., puellaris Fr., lutea Cke.

Cantharellus cibarius Fr., tubaeformis Fr.

Marasmius peronatus Fr., oreades Fr., erythropus Fr., ramealis Fr., rotula Fr., androsaceus Fr., epiphyllus Fr.

Panus stipticus Fr.

Lenzites betulina Fr.

Boletus elegans Schum., flavus With., granulatus Linn., badius Fr., piperatus Bull., chrysenteron Fr., subtomentosus Linn., radicans Pers., pruinatus Fr., fragrans Vitt., laricinus Berk., scaber Fr.

Fistulina hepatica Fr.

Polyporus rufescens Fr., squamosus Fr., intybaceus Fr., giganteus Fr., dryadeus Fr., betulinus Fr., adustus Fr., chioneus Fr., caesius Fr., lacteus Fr., fragilis Fr.

Fomes lucidus Fr., fomentarius Fr., annosus Fr., applanatus Wallr., ferruginosus Mass.

Polystictus versicolor Fr., abietinus Fr., radiatus Fr.

Poria vaporaria Fr., mollusca Fr., terrestris Fr., umbrina Fr.

Daedalea quercina Pers.

Merulius tremellosus Schrad., molluscus Fr.

Hydnum repandum Linn., nodulosum Fr., farinaceum Fr.

Tremellodon gelatinosum Pers.

Irpex obliquus Schrad.

Grandinia granulosa Fr.

Craterellus cornucopioides Pers.

Thelephora terrestris Ehrb., laciniata Pers.

Stereum ochroleucum Fr., purpureum Pers., hirsutum Fr., sanguinolentum Fr., rugosum Fr.

Hymenochaete rubiginosa Lév.

Corticium calceum Fr., nudum Fr.

Peniophora quercina Cke., cinerea Cke.
Coniophora puteana Mass.
Auricularia mesenterica Fr.
Clavaria muscoides Linn., fastigiata Linn., cinerea Bull., cristata Pers., rugosa Bull., Krombholzii Fr., Kunzei Fr., abietina Pers., flaccida Fr., fusiformis Sow., inaequalis Fl. Dan., luteoalba Rea, vermicularis Scop., fragilis Fr., fumosa Pers.
Calocera viscosa Fr., stricta Fr.
Pistillaria puberula Berk.
Tremella mesenterica Retz., albida Huds., sarcoides Sm.
Hirneola auricula—Judae Berk.
Dachrymyces deliquescens Dub., stillatus Nees.
Pilacre faginea B. & Br.
Scleroderma vulgare Fr. verrucosum Pers.
Crucibulum vulgare Tul.
Sphaerobolus stellatus Tode.
Lycoperdon velatum Vitt., excipuliforme Scop., saccatum Vahl., gemmatum Batsch, pyriforme Schaeff., perlatum Pers., plumbea Pers., nigrescens Vitt.
Geaster fimbriatus Fr., rufescens Pers.
Ithyphallus impudicus Fisch.
Mutinus caninus Fr.
Monilia candicans Sacc.
Oedocephalum glomerulosum Sacc.
Rhinotrichum Thwaitesii B. & Br.
Botrytis cinerea Pers.
Mucrosporium sphaerocephalum Sacc.
Helicomyces scandens Morg.
Torula herbarum Link.
Hormiscium hysterioides Sacc.
Periconia pycnospora Fres.
Stachylidium cyclosporum Grove.
Thyrsidium botryosporium Mont.
Pestalozzia lignicola Cke.
Spinellus fusiger Van Tiegh.
Ascomyces turgidus Phil.
Hypocrea rufa Pers.
Diatrype stigma Hoffm.
Hypoxylon fuscum Pers.
Ustulina vulgaris Tul.
Xylaria hypoxylon Linn.
Rhytisma acerinum Fr.
Propolis faginea Karst.
Bulgaria polymorpha Wett.
Coryne sarcoides Tul.
Ascobolus furfuraceus Pers.

Mollisia cinerea Karst.
Helotium claro-flavum Berk., citrinum Fr., virgultorum Karst., var. fructigenum Rehm.
Ciboria ochroleuca (Bolt.)
Chlorosplenium aeruginosum De Not.
Lachnea scutellata Gillet.
Dasyscypha virginea Fckl., nivea Mass., calycina Fckl., hyalina Mass.
Humaria omphalodes Mass., granulata Sacc.
Peziza succosa Berk.
Otidea aurantia Mass.
Helvella crispa Fr., elastica Bull.
Leotia lubrica Pers., acicularis Pers.
Geoglossum viscosum Pers., glabrum Pers., hirsutum Pers.

*Mycetozoa.**

Ceratiomyxa mucida Schroet.
Physarum nutans β & γ Pers., viride Pers.
Fuligo septica Gmel.
Craterium pedunculatum Trent.
Chondrioderma spumarioides Rost.
Didymium effusum Link.
Stemonitis fusca α & γ confluens Roth.
Comatricha obtusata Preuss., typhoides Rost.
Lamproderma irideum Rost.
Cribraria argillacea Pers.
Licea flexuosa Pers.
Trichia scabra Rost., varia Pers., fallax Pers.
Arcyria cinerea Pers., punicea Pers., incarnata Pers.
Lycogala miniatum Pers.

* This list was kindly determined by Miss G. and Mr. A. Lister, F.R.S.

MYCOLOGY AS AN INSTRUMENT OF RECREATION.

PRESIDENTIAL ADDRESS.

By Rev. William L. W. Eyre, M.A.

Ladies and Gentlemen,

In times past we have had the privilege of hearing or reading the words of those whose great abilities I cannot emulate. The intricacies of the *Uredineæ* are beyond me, the methods of a University laboratory exceed any efforts that can be practised in a country Rectory, still, as expected to offer a contribution to advance our common aim, I offer the following. Thirty years ago, Dr. M. C. Cooke, whose life-long perseverance and generous assistance we all, in one way or another, gratefully acknowledge, gave an address on similar lines to the present. Following his lead, I feel in safe hands.

If by any method we can popularise our special study, we may hope to increase the membership of the Society, perhaps prove a sufficiently strong attraction for some to join us who are only deterred from co-operating because we are reputed to be *too scientific.*

It is often well to review our pleasures, and if we recognise our department of Nature's field as at any rate recreative, my remarks may prove a not entirely unsuitable topic for this evening. I turn then to my subject.

Of late years there has been much comment made in our newspapers about the excessive recreation of the English people. One Bishop certainly has lifted up his voice of warning lest recreation destroy the sense of duty, and the holiday side of life be thrust too much into the forefront. Possibly such a caution may be needed, but the recreation which the study of Mycology affords is free from some aspects of the pleasure which the Bishop infers may be carried to excess. In my own neighbourhood the question has been asked, What do you get out of it? From the study of Mycology I am quite as convinced as Dr. Cooke we may secure several things, from our love of Fungi emerge ideas and thoughts of real value. We note differences, we learn to distinguish. Sports train the hand, the foot. There is an education of sense, of nerve, of muscle. The growing passion for them in our time is Nature's set-off to the lowering of vitality which town life and sedentary toil are bringing upon civilized peoples. But says another

public print, sport of all kinds is being abused. We seem incapable, as a people, to steer a middle course in anything. A fashion becomes a craze, a craze developes into a mania. Many never reach beyond the knowledge of the *odds* on a race, the *form* of a footballer, or the *centuries* of a cricketer.

Mycology may here have its part to do. There are many forms of recreation. Ours may be no better than the rest. The amusement and pleasure that suits one person may not suit another. Those who educate themselves in the love of things, either in the animate or inanimate world, need not import envy or greed into a necessity that lies upon us. We all of us require some recreation; the only point is as to its form, and not to allow it to increase upon us so much as to deaden, as the Bishop rightly says, the sense of duty. If life is all play and pastime there is a sad desecration of noble gifts. Ruskin maintains "that the greatest thing a human soul ever does in this world is to see something and tell what it saw in a plain way." We would then look at our study as recreative, for, consider: The study obliges us to make close observation, the numerous forms of Fungi demand attention and skill to detect the minute differences discernible among them. The eye requires tuition, seeing must be cultivated; fortunate the man who is by Nature endowed with the power to see and to appreciate. The capacity of vision increases by practice. When the learner has grasped the language in which, for instance, the parts of the mushroom are described, he may go on to the next specimen he falls in with, if some friend will tell him the name of the species to which his attention has been drawn, he goes with rekindled ardour to hunt it down in his volume of Cooke, Massee, or Stevenson. His vision is expanding; he begins to see sufficiently clearly to work on without dismay or disappointment. It is the earlier steps of any true knowledge of nature that are the most difficult, technical language, and it cannot be altogether avoided, is a hindrance; but patience and renewed effort will conquer this as well as other things. In all walks of life an intelligent and educated eye is of service. It is a serious mistake to allow the power of observation to fall into atrophy from want of use.

In the field of medicine, surgery, and physical science additions are being made continually to the sum of human knowledge. Novelty attends the Mycologist; throughout his career he is always learning. Was there ever a student of Fungi who could not recall something this year that he had passed unnoticed before? Your experience is probably similar to mine, each season reveals some fresh species. It may be new to the scientific world of Europe or America, an addition to the local list which we have been interested in making; forms appear

of which the student says to himself, "How strange that I should have overlooked this hitherto." Sometimes it happens that this particular species comes to be considered as new, not because it is really *new*, but unobserved, owing to its uncertain appearance, the causes of which lie hidden. We remember how abundantly mushrooms prevailed in the autumn of 1901 and were exceedingly scarce in the following year. Novelty is ever with us, and it is a strong point in our method of recreation. Pleasures repeated too often lose their zest, but Fungi never fail to please those who study them. Enjoyment comes and there is no limitation to the enjoyment. If the mind is devoted to classification here is occupation indeed; there are hundreds, even thousands, to arrange in some definite order. Is it the life history, or the geographical distribution, or the chemical constitution? There are prizes to be won; the field is wide and free. Have we any skill with the pencil or brush? For the artist there is an almost endless charm in the effort to copy the forms and tints displayed before us. What more elegant than the marks distinguishing the *Cortinarii?* It is an advantage to the novice in these matters that at the annual meeting he may see these objects in great variety and already named for him. He may often also witness the objects themselves being drawn and coloured by some of our members; if he chooses to make enquiry he will find those ready to satisfy him with courtesy and kindness. For him at least there is a minimum of trouble and he may soon learn what the language of his books have failed to impart.

Our method of recreation takes us out into the open air, clears our mind of the dust and cobwebs of too close an application to an absorbing occupation or professional business. If illness overtake us the time of convalescence may be brightened, the tediousness of a slow recovery be shortened by the study of some special group, *Spherias*, *Peziza*, or the *Mycetozoa* Specimens often lie close at hand and are easily accessible. Friends and relatives are only too glad to look for them and enable us to bring them into the field of the microscope. The water-butt at the back door, the leaves and twigs lying about, will afford occupation for many days. When strength returns we prosecute our favourite recreation with renewed enjoyment. There is a vast area before us, atmosphere as well as land, waiting to be explored. The knowledge we already possess, much of it recorded in our literature, soon requires supplementing or revising. Mr. Biffin pointed out to us last year a species having more than one kind of fruit, and this law, of which we knew something previously, seems likely to gain a much wider extension.

How little do we know at present of the meaning of the various odours that we detect in certain species? Even the definition of it is not always easy; there is an appeal to us which we cannot satisfy. When we attempt to describe (from association with something else that we have recognised), then we find our limitations. It seems possible that there may be as wide a range in odour as there is in colour, but man's sense of smell is so imperfect he cannot go much beyond the statement of pleasant or nauseous, spicy or nitrous.

The arrangement of an Annual Meeting, the details so carefully worked out by our Secretary, takes us into unfamiliar parts of our common country. If we are not all lovers of Fungi we enjoy the pleasure of seeing new places, towns and woodlands, which we should have had no necessity to visit without a definite object. We should hardly have been persuaded to undertake a trip to Ireland or Scotland without some settled purpose. We should have remained quietly at home.

Our need, however, of recreation has tempted us to emerge into the open. Thus we become associated with others, a spirit of cordiality is generated, healthy emulation arises amongst us, we resume our avocations with body and mind refreshed. The particular form of our recreation stimulates to further effort to know and learn more. Our ability in our respective callings is in no way lessened, but rather increased, by our method of taking holiday. I think we can agree to the statement that has been made, There is quite enough work to be done within the compass of a single parish to keep a man's mind fresh and vigorous and to give him a chance of contributing something to the world's knowledge.

The study of Fungi, as it unfolds before us, presents objects of marvellous beauty, and through this method of recreative pleasure, it holds, I venture to think, a high position. There is a beauty of colour, of exquisite workmanship, of graceful form, that offers some of the purest enjoyment that the mind can reflect upon.

"To the attentive eye," says the American Emerson, "each moment of the year has its own beauty, and in the same field it beholds every hour a picture that was never seen before and shall never see again. The heavens change every moment and reflect their glory or gloom on the plains beneath."

The beauty we so often behold among the Fungi is very fugitive, but most striking in its manifestation, it may be visible in a cluster of say scores, of *Craterium* cups growing on a half-buried fir chip, scarlet and orange in shades of remarkable elegance, hidden often from the casual eye till turned upwards to the light of day. We have, too, the vivid tints of red in the *Russulæ* of violet or blue which we associate with the *Leptonias* or the

snowy whiteness of some of the *Hygrophori.* Abundant objects are provided for us, giving rise to the deepest thought. What is the meaning of the odours of *Clitocybe fragrans*, *Nolanea pisciodora*, *Mycena pura*, or that most pungent and peculiar of all the *Truffle.* Through what secret chemistry is it brought about? To whom? or to what end are these things of beauty and fragrance reserved? There are problems here for the acutest and ablest mind to ponder. A person must be indeed careless who is not sometimes compelled to ask whence come these forms, colours, and odours. So exquisite, yet so frail and fleeting. So full of marvel and yet so long unknown; still too little recognized by thousands who tread them underfoot. The heart and intellect may profitably expand under such genial influences. Their beauty and interest can be no chance endowment. It is God's hall mark attesting that the works are His. The before-mentioned Emerson says, "Beauty takes us out of surfaces to thinking of the foundation of things," or, the German Goethe, "the beautiful is the manifestation of the secret laws of Nature, but for this appearance had been for ever concealed from us." There is the gratification then to the reverential and humble soul that he is lifted by this method of recreation to a higher plane. Our knowledge of Fungi, as it increases, will be an additional evidence of the manifold wisdom that embraces us.

While forms come and go they show us something of the invisible energy that surrounds us. We gaze upon the unceasing work of our Creator. We bow the knee to gather our specimens in the presence of the King of Glory.

Syllabus 1. Close observation necessary—the eye to be trained.

2. Increase of human knowledge, novelty in the pursuit.

3. An open-air recreation—change of scene often beneficial to mind and body.

4. We realize a sense of Divine beauty in a world of unnoticed things.

ON THE OCCURRENCE OF ECHINOSTELIUM MINUTUM DE BARY, NEAR HEREFORD.

By G. & Arthur Lister, F.R.S.

When the British Mycological Society met at Hereford in the autumn of 1902 to study the fungi of that district, Miss A. L. Smith put aside a part of the material collected, for further examination in London. Fragments of decaying vegetable matter were placed in a cultivating chamber at the British Museum, Nat. Hist. From this material there arose a scattered growth of extremely minute, Mucor-like bodies, scarcely visible without the aid of a lens. Under the microscope they showed a globular head, principally composed of spherical colourless spores, supported on a slender, colourless stalk. After some unsuccessful attempts to germinate the spores, Miss Smith made a glycerine mounting of the specimen, which she kindly submitted to us last autumn. It consists of about twelve sporangia of *Echinostelium minutum* de Bary dispersed over a small fragment of dark vegetable substance. No unbroken heads remain in the preparation, but they appear to have measured about 50 μ in diameter. The stalk consists of a delicate hyaline membrane, enclosing almost colourless granular refuse matter; it is about 0.5 mm. in length, 25 μ broad at the base, gradually tapering to 2 μ at the apex; it is continued into the sporangium as a short columella 3 μ to 5 μ long, from which there springs a scanty colourless capillitium; this consists of two or three main threads branching in a zigzag manner, sparingly anastomosing above and provided with many free, spine-like branchlets. At the base of the columella, in most of the sporangia, two to four globose colourless spores, 6 μ diam., remain attached, precisely as figured by Rostafinski in his excellent drawing reproduced in Cooke's Myxomycetes of Great Britain, fig. 54. The life history and the character of the plasmodium are at present obscure, but the species appears to be rightly placed by Rostafinski among the Mycetozoa in the division *Stemonitaceæ;* it would seem to be most nearly allied to *Clastoderma Debaryanum* Blytt. This is, we believe, the first record of *Echinostelium minutum* having been obtained in Britain.

Highcliff, Lyme Regis, January 26, 1904.

DISEASES OF PLANTS DUE TO FUNGI.

By A. Lorrain Smith.

GLOEOSPORIUM TILIAE OUD.

An instance of loss caused by this fungus was brought under my notice in June of this year. The leaves of some lime trees in Oxfordshire were stripped from the branches in large numbers during a gale of wind. There had been severe cold and frost, which might have injured the leaves; and there had been a hail-storm, which had undoubtedly torn and injured the foliage. These factors, however, did not seem sufficient to account for the damage done, especially as the leaves when they fell were at their fullest vitality. The owner of the trees had noticed black patches on some of the leaves and, on the petioles of those that had fallen, a small burnt-like spot was nearly always present at the point of rupture.

Microscopic examination shewed that the blackened areas were due to the death and discolouration of the cells of the cortex, and on these were seated the small pustules of a *Gloeosporium*, a fungus belonging to the Melanconieae group of *Fungi imperfecti*. The injury in some cases had not gone any deeper than the superficial layers of the cortex, in others the mycelium had penetrated to the bundle strand and corroded half-way through the tissue of the stalk. The damage done to the conducting tissue was in no case sufficient to kill the leaf or to sever its connection with the branch, but the weakened petiole was no longer able to resist the force of any strain, and the wind had been the final agent of destruction.

The spots on the leaves were also caused by the same fungus. They were characterized by a central grey portion, visible on both surfaces, the decolouration being caused by the parasite having destroyed the contents of the cells; the *Gloeosporium* pustules looked like tiny blisters scattered over the discoloured spots: a dark line surrounded each patch.

Gloeosporium, like other Melanconieae, does not form a definite fruiting body. The one-celled spores are borne at the tips of short upright hyphae, which rise from a compacted base of fungal hyphae, localized in little masses and formed under the epidermis of the host plant. The swelling of the epidermis, which bursts at a definite central point to allow the escape of the spores, gives, however, more or less the appearance of a perithecium. The size of the spores found on the Oxfordshire specimens varies very much. They measure about 10 $\mu \times 2\frac{1}{2}\ \mu$, some being much smaller. It has been recorded from Holland, Italy and Australia, but only on the blade of the leaf, where it

is comparatively harmless. A similar fungus appears on the young shoots, leaves and fruits of the vine, causing extensive damage. Another, Gl. nervisequium, attacks the leaves of the Plane; the mycelium passes down the veins into the petiole, and results there also in the fall of the leaf, but in a slightly different way, as no pustules appear on the leaf stalk.

SEPTORIA FRAGARIAE.

This fungus, one of the Sphaeropsideae, also in the group of "*Fungi imperfecti*," is recorded on the leaves of *Fragaria* and other allied plants. It occurs on brown spots, the perithecia are very minute and open by a wide pore. A cultivated strawberry was brought to me as one of a crop that had been very much damaged and rendered unfit for market. I had no leaves to examine, but the bracts were covered with the perithecia of the fungus. The strawberry itself was ripe and well formed, but here and there all over it were withered spots. The seeds were very hard and the tissue all round dried and juiceless. Perithecia of *Septoria* were found there also and were undoubtedly the cause of the injury to the fruit. There was a rich growth of mycelium in the cells beneath the damaged spots. The spores are elongate-cylindrical, 3-septate and colourless, and measure about 35 μ × 4 μ. There is no size recorded in the published description. There is no record that I can find of the fungus having passed from the leaves to the fruit. The fruits came from a grower near Southampton, but I was unable to get sufficient material to carry out a more complete investigation.

NOTES ON FUNGI RECENTLY COLLECTED.

By A. Lorrain Smith.

Gonytrichum caesium Nees. This somewhat rare fungus was collected in the Autumn on sticks in a Dumfriesshire wood. In several details it differs from the published and figured specimens and yet is so near akin that it is evidently the same species. The brown filaments are intricately branched, tapering and colourless at the tips about 2·5 μ in diameter; a few septa are faintly visible. The conidiophores are bottle-shaped up to 8 μ in length by 3 μ at the widest part, and they cluster round the nodes and at intervals along the branches. The swelling at the nodes is barely perceptible, or altogether absent. The globose

head of spores is about 4 μ in diameter; the spores are oblong and extremely minute, about 2·5 μ in length.

Rhinotrichum Thwaitesii B. & Br. This fungus was found in great abundance on dead leaves at Savernake. The conidiophores grew in coremium-like tufts. The stalk hyphae, closely compacted, were septate 6·7 μ in width. Towards the top of the tuft they branched and spread out in a loose, fluffy manner. The tips of the branches were clavate, about 12 μ in width, very delicate in texture and studded with sessile echinulate, globose spores 5 μ in diameter. The whole plant was white, changing to a rosy, brick-red shade.

Oedocephalum glomerulosum Sacc., usually recorded on dung, was found growing on rotten wood.

NOTES ON TWO PHALLOIDEAE NEW TO EUROPE.

By Carleton Rea, B.C.L., M.A., &c.

WITH PLATE III.

The Phalloideae chiefly inhabit the tropical and sub-tropical regions of the world, and out of about 75 species described up to the present time only eight have been recorded as European. These are, *Ithyphallus impudicus* Fisch., I*thyphallus imperialis* Kalch., *Mutinus caninus* Fr., *Mutinus bambusinus* Fisch., *Clathrus cancellatus* Tournef., *Colus hirudinosus* Cav. & Séch., *Anthurus borealis* Burt variety *Klitzingii* P. Henn and *Aseroe rubra* La Billard. The British list only includes five species, viz., *Ithyphallus impudicus*, *Mutinus caninus*, *Mutinus bambusinus*, *Clathrus cancellatus* and *Aseroe rubra*. To these I have now the pleasure of adding *Lysurus australiensis* Cke. & Mass., which was brought to me by our fellow-member, Mr. D. P. Goodwin, on the 14th of November, 1902, who discovered it in a pasture field adjacent to his flour mill at Kidderminster, Worcestershire, near to a spot where the refuse and dirt had been emptied out of the empty sacks which had probably contained Australian wheat.

The genus *Lysurus* Fr. Syst. Myc. II. p. 285 is thus defined by Cooke in his Handbook of Australian Fungi, and is practically the same as is adopted by both E. Fischer in his Phalloideen and Saccardo in his Sylloge: "Receptacle stipitate, divided above in vertical lobes, free at the apex, *distinct from the stem.* Sporiferous pulp on the interior of the lobes." And at p. 216 of the Handbook of Australian Fungi the *Lysurus australiensis* Cke. & Mass. Grev. vol. xviii. is also given as a synonym for *Mutinus sulcatus* Cke. & Mass. described in Grev. vol. xvii. The description there given is, "Receptacle 2-3 cm.

long, tawny, for the most part five-lobed; lobes attenuated upwards, at first connivent, then somewhat reflexed, with a longitudinal depression along the middle, transversely rugose. Stem cylindrical, 10-12 cm. long, nearly 2 cm. thick, hollow, cellular, whitish. Volva globose, torn in lobes, white. Pulp rufous brown, becoming blackish. Spores 3×1 μ. On the ground, Queensland."

I think the above description well accords with the following notes which I drew up at the time, and as I hold the opinion that every plant added to the British list should be fully described by the recorder so that botanists may be enabled to judge what variation (if any) there be in the plants found on British soil. Stem cylindrical, 6 cm. long, 2 cm. wide, but attenuated at the base within the volva to 1 cm., whitish, hollow, net-celled, divided at the apex into six arms, Arms deep rich reddish brown, 15-20 mm. long, 5-8 mm. wide at the base, attenuated at the apex, longitudinally one-grooved down the centre and transversely cross-ribbed, erect, slightly incurved at the apex, hollow except at the extreme apex, not net-celled, but of a different texture to the flesh of the stem. Volva 4 cm. wide, white, irregularly torn, and with white strands of mycelium all round the base. Spores reddish brown, $3 \times 1{\cdot}5$ μ.

The whole plant at first sight looks like a Sea Anemone with its reddish brown tentacles and whitish stem seated in the volva of an ordinary *Amanita phalloides*.

It is a curious fact that in August of last year Klitzing at Ludwigslust, Mecklenburg, Germany, found a variety of an American phalloid growing in a field of asparagus, which is described in Beiblatt zur "Hedwigia" Band xli., 1902, pp. 167-174, as follows:— "*Anthurus borealis* Burt variety *Klitzingii* P. Henn. Mycelium filiform or root-like, branched, white; exoperidium at first subglobose, then ovoidellipsoid, 3 cm. long, $2\frac{1}{2}$ cm. wide. Volva white on the exterior, papyraceous, middle layer gelatinous, inner layer membranaceous, white longitudinally striate, irregularly lobed. Stem clavate. attenuated at the base, 2 cm. wide at the apex, 2-$7\frac{1}{2}$ cm. long, quite hollow inside, whitish outside, net-celled, wall at base of 1-2 layers higher up of 3 layers, a thickened ring at the apex which is divided into 5-7 narrow lanceolate arms; arms with a longitudinal furrow down the middle which is naked, white and sub-silky, but everywhere, except at the base, on the inside transversely rugose, whitish, clothed with the chestnut mass of spores, then free, separate, erect, apex obtuse or subacute, 1-$2{\cdot}8 \times 0{\cdot}4$-$0{\cdot}5$ cm. Basidia oblong, clavate, continuous; spores 5-8 ellipsoid, subfusoid, light green, $3{\cdot}5$-$4 \times 1{\cdot}5$-2 μ. Anthurus borealis is described as light flesh coloured, the spore masses olive green; the variety is never olive green."

Now the genus *Anthurus* Kalch Grev. ix. p. 2 is defined by Cooke and the same authorities I cited for Lysurus as having the receptacle stipitate, or with a very short stem, divided above into erect patent

E. A. Rea del.

West, Newman chromo London.

A. Lysurus australiensis *Cke & Mass.* B. Clavaria luteoalba *Rea.*
C. Lycoperdon velatum *Vitt.*

laciniae, free at the apices, but *running down direct into the stem and not distinct from it.* The leading feature of distinction between these closely-allied genera, then, seems to be that in *Anthurus* the flesh of the stem passes unchanged into the arms, whereas in *Lysurus* the flesh of the arms is of a different character to that of the stem. If this be the correct distinction between these two genera, then I am bound to say that I feel compelled, both by the description and the plate issued therewith, to consider this German species as rather appertaining to *Lysurus* than *Anthurus*.

As these notes are dealing with the Phalloideae, I feel you will permit me a digression in drawing your attention to *Phallus imperialis* Kalch. This species I had the privilege of seeing in some numbers in the vicinity of Malesherbes in France, on the 14th and 15th of October in last year. It is very similar to *Phallus impudicus*, but is characterized by the exterior of the volva, being rose colour, the light blue strands of mycelium at the base of the volva, the orbicular disc at the summit of the pileus which is generally delicately crenate, and absence of any distasteful smell.

I personally noticed no appreciable scent even after the specimens had been boxed and then on opening the receptacle in which they had been contained, but I heard the French mycologists describe it as *odeur d'eglise*. This expression I was in doubt of as to their meaning. Did they refer to the damp, earthy smell we meet with in some of our churches on Sunday, or was it that of spent incense? I have drawn your attention to this species because I think we have probably overlooked its occurrence in Britain; and I recommend all our members who have the opportunity of working pine woods in a calcareous, sandy soil to add this Phalloid to our list.

FUNGI NEW TO BRITAIN.

By Annie Lorrain Smith and Carleton Rea, B.C.L., M.A., &c.

WITH PLATES III., IV. & V.

Phellomyces sclerotiophorus Frank.

Found by Prof. T. Johnson on potato-tubers from various parts of Ireland. Econ. Proc. Roy. Dubl. Soc. I. 1903, pp. 161-165.

Resticularia nodosa Dangeard. Recherches histologiques sur les Champignons. Le Botaniste 2nd sér. 1890-1, pp. 96-9, pl. 4, figs. 24-31.

Growing on rocks in the *Nepenthes* house at Kew, Oct., 1902. F. E. Fritsch. Ann. Bot. XVII., 1903, p. 650.

R. Boodlei Fritsch. l. c., p. 654.

In the filaments of a Tolypothrix in a pond, Richmond Park.

Gloeosporium Tiliae Oud.*

On the leaves and petioles of the lime, Oxfordshire, June, 1903.

Oedocephalum clavatum A. L. Sm. Jour. Bot. XLI. (1903), p. 259, pl. 454, figs. 11 and 12.

On a laboratory culture of a hyacinth root, Norwood.

Helicomyces scandens Morg. North Am. Helicosporeae. Cincinn. Soc. of Nat. Hist. XV. (1892), p. 42.

Effused, forming a rose-coloured setulose stratum. Hyphae climbing, hyaline, septate, branched, bearing the spores in dense clusters on minute lateral teeth; spores linear, hyaline, sometimes guttulate, faintly multiseptate, coiled 3-4 times, the thread 150-200 μ in length, 2·5-3 μ thick, the inner extremity acute, the outer obtuse.

Growing on old wood and bark, A.L.S.

The specimen that grew on sticks collected at Savernake forms an effused faintly rose coloured stratum. The hyphae tend rather to climb any available erect body. There are no dark threads intermixed as in the American species, but Morgan thinks these are foreign and accidental. The spores are in dense clusters, and are coiled exactly as in Morgan's species, the threads have the same width, and they measure up to 245 μ in length.

Haplographium chlorocephalum Grove in Science Gossip, 1885, p. 198.

On leaves of furze, &c., Torquay, Devonshire, February, 1903. New or critical micro-fungi by A. Lorrain Smith, Journ. Bot. XLI. (1903), p. 257.

Brachycladium botryoides A. L. Sm. l. c., p. 258.

Growing on germinating grass seeds, Norwood, April, 1903.

Ampullaria aurea A. L. Sm. l. c., p. 258.

Growing on dead clover seeds, Norwood, April, 1903.

Ctenomyces serratus Eidam in Cohn's Beitr. zr. Biol. iii. (1880), p. 274.

On decaying beech and other leaves in Hampshire. Rev. W. L. W. Eyre. A. L. S. l. c., p. 257.

*See p. 55 hereof.

Since the above was published Mr. E. S. Salmon has drawn my attention to the description and figures of *Arthroderma Curreyi* Berk. published by Currey in the Quart. Journ. Micrs. Sci. II. (1854), p. 241, and again described by himself in the Journ. Quek. Micrs. Club, Nov., 1900. Mr. Salmon kindly allowed me to see a preparation of his fungus, and also a specimen from the Kew Herbarium determined by Cooke as A. Curreyi. Though on both occasions the fungus was described and published as a Hyphomycete; it is identical with the Ascomycete *Ctenomyces serratus* Eidam. Currey's genus and Berkeley's species have many years' priority, and the original name, *Arthroderma Curreyi*, must take precedence according to rule.

Tichothecium Flotow (in Koerber Krypt-Kunde 1848, p. 199).

Perithecia more or less immersed, emerging later, of a somewhat firm horny-carbonaceous substance, black, with a simple open pore; spores 8 or more in the ascus, 2 or 4-celled, brown; paraphyses coherent in a mucilaginous mass or wanting.

T. pygmaeum Körb. Parerga Lichenol., p. 467.

Perithecia scattered, entirely—or to a large extent—immersed, usually only the ostiole emerging, globose, shining, 0·1 mm. in diameter, asci broadly clavate, tapering downwards to the stalk, many-spored, about 47-52 μ long × 12-14 μ broad, spores irregularly massed, elliptical, slightly constricted, 2-celled, brown, 6-8 $\mu \times$ 3-3·5 μ.

On the thallus of various stone encrusting Lichens. On the apothecium of Lecanora sp. on sandstone by the banks of the river Annan, Dumfriesshire, September, 1903. A. L. S.

Valsa heteracantha Sacc. Myc. Venet. Spec., p. 129.

Collected by Mrs. Montague in Devonshire, April, 1903. A. L. S., l. c., p. 257.

Amanita junquillea Quél. Bull. Soc. Fr., XXIII. 1876, p. 324 pl. 3, f. 10.

"This differs from *Amanitopsis adnata* W. Sm. in the striate margin of the pileus, in the presence of an annulus and in the much smaller spores."* Drawing of the plant in Herbarium British Museum. Worthington G. Smith Journ. Bot. XLI. (1903), p. 385.

Lepiota nigro-marginata Mass. Eur. Fung. Fl., p. 10.

Pileus campanulato-expanded, subumbonate; scales umber on a pale sienna-ochre ground. Stem hollow, attenuate upwards, smooth,

* See Transactions British Mycological Society, vol. I., p. 40.

salmon white; annulus distant, persistent, membranous, white. Gills broader in front, whitish; edge bordered with dark umber. Flesh thin, $2 \times 2\frac{3}{4} \times \frac{1}{8}$ in.

Amongst grass, Scarborough, May, 1885. W. G. Smith l.c. p. 385.

Lepiota atrocrocea W. G. Sm. Mass. Eur. Fung. Fl., p. 11.

Pileus expanded, slightly depressed; bright salmon-orange; more or less covered with purple-brown, almost black, granular flocci. Stem hollow, attenuate upwards; bright salmon-orange; salmon-brown squamulose. Annulus fugacious. Gills broadly adnate; salmon white. Flesh thin; salmon-orange-brown. $1\frac{1}{2} \times 1\frac{1}{4} \times \frac{1}{8}$ in.

Clevedon, Somerset, Oct., Edwin Wheeler. Allied to *L. granulosa* Batsch. and *L. amianthina* Scop. W. G. Smith l.c. p. 385.

Tricholoma squarrulosum Bres. Fung. Trid., Vol. II., p. 47, pl. 152, see pl. 4.

Pileus fleshy, 4-8 cm. across, convex then expanded, fuscous, densely covered with blackish squamules, dry, margin exceeding the gills and fibrillose. Stem 4-5 cm. high by 7-12 mm. thick, stuffed then somewhat hollow, equal or incrassated at the base, of the same colour as the pileus and *densely covered with blackish fuscous squamules.* Flesh greyish, then white. Gills sinuato-adnexed, almost free in some specimens, 6-7 mm. wide, crowded, grey, occasionally spotted with red when bruised. Spores elliptical, $7\text{-}8 \times 4\text{-}5\mu$.

Under oaks and hazel, Black House Hill Wood, Worcestershire, 17th September, 1903. C. Rea.

Easily distinguished from its allies by the blackish fuscous squamulose stem.

Collybia Henriettae W. G. Sm. Jour. Bot. XLI. 1903, p. 139.

Pileus dry, even, somewhat downy, somewhat yellowish umber, 4 in. diam. Stem attenuate upwards, subpruinose, even, slightly rooting; pale pallid yellowish brown within and without, $7\frac{3}{4}$ in. long, $\frac{1}{4}$ in. thick. Gills $\frac{5}{8}$ in. broad, broadly adnate, distant, slightly rounded near the stem. Flesh very thin. Spores $\cdot0005 \times \cdot0007$ in.

Intermediate between *Collybia radicata* Rehl. and *C. longipes* Bull.

On and about stumps, trees, &c., September.

This species differs from *C. radicata* in the dry, even, not glutinous, rugose pileus and in the much thinner flesh; in the even, subpruinose, not sulcate and glabrous stem, and in the broadly adnate attachment of the gills to the stem. It has not the fleshy, velvety pileus and stem of *C. longipes*, and differs widely in the attachment of the gills to the stem, adnexo-free in *C. longipes*.

Tricholoma squarrulosum *Bres.*

F.A. Rea del

West, Newman chromo London.

Inocybe corydalina *Quél.*

"In the Transactions for 1902, at p. 14, this species appears to be described under the name of C. subelevata W. G. Sm. Neither the description nor the name is mine, and I have seen the same description with another author's name. It must have been drawn up by someone from imperfect notes and from an imperfect copy of the original drawing in the British Museum. At any rate, no such species as C. subelevata exists. In my plant the gills are broadly adnate not adnexed." W. G. S.

Collybia planipes Brig. Fr. Hym. Eur., p. 121.

A. Clarke, Epping Forest, September, 1903. Naturalist, Nov., 1903, p. 427.

Pleurotus rufipes Mass. & W. G. Sm. Jour. Bot., XLI. (1903), p. 385.

Pileus dimidiate or reniform, convex, membranous, very glutinous when moist; white; middle salmon, margin incurved. Stem becoming recurved; viscous-reddish; salmon red within; white in centre; base downy. Gills adnate, broad, distant; white; interstices pale salmon. Pileus $\frac{1}{8}$ in. diam., stem $\frac{3}{16}$ in. long, $\frac{1}{40}$ in. diam.

On wood. Drawing by G. Massee in British Museum.

Nolanea rhodospora Broome & W. G. Sm. Jour. Bot., XLI., 1903, p. 385.

Pileus convex; sooty-fibrillose or rufescent-pilose. Stem subbulbous; white. Gills sinuate or free, salmon or rose. $1 \times 1\frac{1}{4} \times \frac{1}{16}$ in.

On earth and wooden labels in stoves. May–September.

Inocybe corydalina Quél. Jur. et Vosg., III., p. 115. See plate 4.

Pileus fleshy, 3-6 cm. across, campanulate then expanded, umbonate, whitish covered with bistre fibrils, *green at the umbo.* Stem 3-5 cm. long, 5-10 mm. thick, solid, curved, sub-bulbous, whitish, striate, pruinose. Flesh white becoming yellowish with age. Odour pleasant (like the scent of Corydalis cava, according to Quélet). Gills adnate, emarginate, 5-7 mm. wide, whitish then brown, edge fimbriate and white. Spores elliptical $7\text{-}9 \times 4\text{-}5\mu$ brown. Cystidia fusiform, ventricose $42\text{-}51 \times 15\text{-}18\mu$.

Under oaks, Crew's Hill Wood, Worcestershire, 17th September, 1903. C. Rea.

Easily known amongst the *Laceri* group by its green prominent umbo.

Inocybe praetervisa Quél. Bres. Fung. Trid., Vol. I., p. 35, pl. 38. See plate 5.

Pileus fleshy 2-6 cm. across, conico-campanulate then expanded,

umbonate or gibbous, often splitting at the margin with age, *slightly viscid*, *fibrillose*, glabrous at the centre, soon *longitudinally virgate*, *fawn* but generally darker at the margin. Stem 4-7 cm. long, 4-8 mm. thick, solid, round, pruinose at the apex, base bulbous and marginate, slightly attenuated upwards, *white* then pale straw-colour with age. Flesh white, odour somewhat earthy. Gills attenuated behind, adnexed, almost free, narrow, 3 mm. wide, crowded, white then dirty cinnamon with a white fimbriate edge. Spores angular 9-11 × 5-6μ yellowish ochre. Cystidia fusiform, ventricose, 55-75 × 18-30μ, somewhat fuscous at the apex.

On the ground, Swarraton, Hants., 15th August 1903. Rev. W. L. W. Eyre.

Distinguished from Inocybe fastigiata and rimosa by its long angular spores and white or pale straw-coloured stem.

Inocybe brunnea Quél. Soc. Sc. n. de Rouen, 1879, pl. 2, f. 7.

Pileus campanulate, 3-5 cm. across, umbonate, fibrillosely silky, then cracked, *chestnut*. Stem 6 cm. high, 5 mm. thick, stuffed, thickened at the base, *fibrillosely striate*, light brown, white and pruinose at the apex. Cortina *concolorous* and fugacious. Flesh white. Gills emarginate, broadest in front 5 mm. wide, cream colour then umber, with the edge white and indented. Spores bistre 7-12 × 4-6μ.

Amongst grass near Pines, Savernake Forest, 9th October, 1903.

Inocybe fulvella Bres. Fung. Trid., Vol. II., p. 16, pl. 119, f. 2.

Pileus 6-12 mm. across, conico-campanulate then expanded and umbonate, flocculosely silky, glabrous at the centre, somewhat hygrophanous, olivaceous honey-colour with the umbo somewhat darker then becoming yellowish or fuscous olive with the umbo tawny. Stem 2-3 cm. long, 1-2 mm. thick, stuffed, attenuated downwards, glabrous, white pruinose at the apex, lilac but soon changing to rufescent. Flesh yellowish, 2 mm. thick at the centre of the pileus, lilac at the apex of the stem and then rufescent. Gills ventricose, 1-5 mm. wide, rounded behind and almost free, subdistant, lilac then cinnamon, edge fimbriate. Spores ferruginous, angular and warted 7-9 × 5-6μ. Cystidia fusiform, ventricose 45-60 × 10-18μ, somewhat fuscous at the apex.

Amongst moss. Wyre Forest, Salop, 31st August 1903. C. Rea.

The lilac tint of the stem, flesh, and gills can only be observed in the field as it very quickly disappears with age or dryness.

Agaricus versicolor With. Ed. 3, Vol. IV., p. 166 (1796).

This Worthington G. Smith refers to *Armillaria mellea* Vahl. Jour. Bot. XLI. (1903), p. 341.

Schulzeria Grangei *Eyre.*

F. A. Rea del.

West Newman chromo London.

Inocybe praetervisa *Quél.*

Hypholoma pseudostorea W. G. Sm. Jour. Bot. XLI. (1903), p. 386.

Pileus convex, obtuse or subumbonate, then expanded, fleshy; at first purplish-brown with a darker middle, soon breaking up into large, fibrillose, purplish-brown scales, silky-white to pale fawn beneath the scales; margin appendiculate and entire when young. Stem hollow, equal or attenuate downwards, at first even, then silky-brown fibrillose; white above, pale yellowish below. Gills adnate, at first white, then rose, becoming brown to purple-brown; not exuding drops of water. Usually caespitose, sometimes solitary. Taste insipid, somewhat disagreeable; odour strong, disagreeable. Spores 5-7 × 2·5-3μ. $2\frac{7}{8} \times 4\frac{1}{2} \times \frac{1}{2}$ in.

Woods, plantations, under larches, September-November.

This is the plant usually described, when found in this country, as A. storea Fr. Dr. Plowright* thinks it is *H. lacrymabundum* Fr., but as our plant never has any tear-drops it can hardly be *H. lacrymabundum*. Spores of *H. lacrymabundum* 9-11 × 6μ.

Paxillus porosus Berk. W. G. Smith, Jour. Bot. XLI. (1903), p. 386.

Not unlike *P. involutus*, to which it is allied, but the margin is never involute, and the pores are sulphury-green, changing to pale blue or brownish when bruised. $4\frac{3}{8} \times 3\frac{7}{8} \times \frac{3}{4}$in. Tasteless, odour very strong, unpleasant.

Moist woods, under firs. Small forms somewhat resemble *Boletus piperatus*.

Hygrophorus melizeus Fr. Hym. Eur., p. 406, Fr. Ic., t. 165, f. 3.

Rievaulx, collected at Yorkshire Fungus Foray. Naturalist, November, 1903, p. 426.

Hygrophorus Karstenii Sacc. and Cub.

The record of *H. bicolor* Karst., noted in the Naturalist for Nov., 1902, p. 356, and at p. 38 of the Trans. Brit. Myc. Soc., Vol. II., should be altered to *Karstenii*, as there is another *H. bicolor* B. & Br. W. G. Sm. Jour. Bot., XLI. (1903), p. 314.

Hygrophorus Clarkii B. & Br. Ann. and Mag. Nat. Hist., May 1873, p. 341.

Worthington G. Smith identifies the *H. latitabundus* Britz., described by M. C. Cooke on p. 14 of the Trans. Brit. Myc. Socy., Vol. II., as this species. Jour. Bot. XLI. (1903), p. 314.

*See Trans. Brit. Myc. Soc., Vol. I., p. 45. It is referred to *H. cotoneum* by Quél CR.

Lactarius sanguifluus Fr. Epicr., p. 341. Fr. Hym. Eur., p. 431.

Resembles *L. deliciosus*, but the milk in place of being orange is deep blood-red changing to green. $2\frac{1}{2} \times 2 \times \frac{3}{4}$ in.

Wick, 21 October, 1845. Drawing in British Museum. W. G. Smith, Jour. Bot. XLI. (1903), p. 386.

Poria obliqua Fr. Syst. Myc., p. 378. Fr. Hym. Eur., p. 570. Fr. Icon., 188, f. 1.

Broadly effused, 4-9 m. thick, flesh thin, from pale to brownish-black, edge usually raised, crested; pores very small, long, somewhat angular; spores globose, brown, 5-7μ in diameter.

On dead trunks of *Citrus*, *Alnus*, *Robinia*.

Guildford, February, 1883. C. E. Broome. Example in British Museum. W. G. Smith, Jour. Bot. XLI. (1903), p. 386.

Merulius confluens Schwein. Syn. Fung. Car. 1822. No. 836.

Resupinate, longitudinally effused, somewhat fleshy, margin free, inflexed, sub-tomentose, pallid, folds uneven, reticulate, porose.

On branches of *Alnus*.

Leigh Wood, Clifton, August, 1843, C. E. Broome. W. G. Sm. Jour. Bot. XLI, (1903), p. 386.

Cyphella griseo-pallida Weinm. Ross Obs. Rec., 1836, p. 522. Fr. Hym. Eur. p. 662.

Sub-membranaceous globose to campanulate, sessile *pallid-grey, exterior floccose*; hymenium smooth; spores ovate acuminate.

On trunks and branches of various trees. On elm and elder bark, December, 1873, C. E. Broome. Examples in British Museum. W. G. Sm. Jour. Bot. XLI. (1903), p. 386.

Clavaria luteoalba Rea. Pl. 3.

Clubs simple, fasciculate or scattered, stuffed, 4-5 cm. high x 2-3 mm. thick, gradually attenuated to the base, *apex constantly white*, acute or blunt, the remainder of the club being of a deep rich yellow. Spores white, pip-shaped, 5-6 x 3μ.

Amongst grass and bracken, Invermay, Perthshire, 30th September, 1903, and Savernake Forest, 6th to 10th October, 1903, C. Rea.

Distinguished from all other yellow *Clavariae* of the *Syncoryne* group by the apex, which is white from the very first.

Geaster umbilicatus Fr. Syst. Myc. iii., p. 14.

Exoperidium multifid, segments laciniate, unequal, sub-lanceolate,

soft, somewhat flattened, sooty brown inside; endoperidium globose or globose-depressed sessile, umbilical centre orbicular, depressed, marginate; peristome conical, plicate-striate, fimbriate at the apex and twisted; capilitium brown; spores globose, 3·5-4μ diam., umber-brown.

On the ground, Hereford, November, 1870. W. G. Sm. Jour. Bot. XLI. (1903), p. 387.

Sphaerobolus dentatus (With). W. Sm. Jour. Bot. XLI. (1903), p. 280.

Peridium finely pilose with erect hairs, springing from scanty brownish mycelium, opening above in a 4-7 stellate manner, the rays clad with long white hairs, which at first converge over the opening; outside pale livid-buff to vinous brownish, pale brown, or brown; inside white, ivory, white-greyish, or faint olive-ivory; ejecting a reddish-brown peridiolum. $\frac{1}{16}$in. diam., scattered.

Dead elder, Failand, Somerset, R. Baker, August, 1888.

The following Members have joined the British Mycological Society during the year 1903.

Adams, Mr. Alfred, M.A., M.B., Bridgend House, West Looe, Cornwall.
Amphlett, Mrs. Eliza A., Dalehurst, 7, Bardwell Road, Oxford.
Clarke, Mr. James, Chapel House, Paisley.
Claridge, Miss M., 8, Park Terrace, Oxford.
Grafton, Miss May, Stoke Prior.
Grant, Mr. Angus, Drumälan, Drumnadrochit.
Lister, Mr. Arthur, F.R.S., Leytonstone and Highcliff, Lyme Regis.
Lister, Miss Gulielma, Leytonstone and Highcliff, Lyme Regis.
Miles, Miss Mary, L.L.A., Laurel Bank, Bridgend, Perth.
Ogle, Mr. B. S., Hill House, Steeple Aston, Oxford.

OFFICERS FOR THE SEASON 1903.

President: The Rev. W. L. W. Eyre, M.A., Swarraton, Alresford, Hants.

Vice-President: Professor H. Marshall Ward, D.Sc., F.R.S., &c., University Botanical Laboratory, Cambridge.

Hon. Secretary and Treasurer: Carleton Rea, B.C.L., M.A., &c., 34, Foregate Street, Worcester.

Published 14*th April*, 1904.

THE WHITBY FORAY.

12th to 17th September, 1904.

The eighth annual week's Fungus Foray was held in the neighbourhood of Whitby, where the Hotel Métropole was constituted the headquarters for the meeting. The members assembled at Whitby on the evening of Monday, the 12th of September, and proceeded to discuss some specimens that they had brought with them. Dr. D. Paul offered for inspection some examples of the somewhat scarce *Inocybe calamistrata* Fr. which he had received from our fellow member Mr. Angus Grant, from the neighbourhood of Drumnadrochit. Dr. W. Watson handed round some very large specimens of *Peridermium pini* (Willd.). Mr. W. B. Allen exhibited some nice forms of *Collybia extuberans* Batt., *Inocybe maritima* Fr., *Cortinarius (Inoloma) traganus* Fr., *Polyporus rufescens* Fr. and *Mitrophora semilibera* Lév. And on the following morning the Hon. Sec. drew their attention to a specimen of *Hydnum graveolens* Delast. which he had recently received from their member Dr. Adams, of Looe. This fungus possesses a very strong penetrating smell suggestive of Fenugreek or Belladonna.

On Tuesday, the 13th of September, the members booked by the 10.5 train from the Town Station to Egton, from whence a short walk brought them to the Arncliffe Woods. These woods are very picturesquely situated on the banks of the River Esk and in a favourable season abound with fungi, but only the following were found worthy of note: *Mycena haematopus* Pers., *Amanita virosa* Fr., *Inocybe hystrix* Fr., *Naucoria sobria* Fr., *Russula densifolia* Secr., *Cortinarius (Phlegmacium) decoloratus* Fr., *(Telamonia) armillatus* Fr. *(Hygrocybe) bicolor* Cke. and *Cordyceps ophioglossoides* Fr. parasitic on *Elaphomyces variegatus* Vitt. After the woods had been thoroughly searched the members returned by train from Glaisdale to Whitby and proceeded at once to place out the more uncommon specimens on exhibition in a sitting-room at the Hotel Métropole which was exclusively reserved for the use of the members during the remainder of the week. At the evening meeting (in the absence of the President, Mr. Worthington G. Smith, F.L.S.) Dr. W. Watson was unanimously called upon to preside over the meetings during the foray. A vote of condolence and deep sympathy was then carried with The Cryptogamic Society of Scotland at the great loss they and all other British mycologists

had suffered by reason of the lamented death of their late secretary, the Rev. John Stevenson, L.L.D., and a similar resolution was passed to his widow and family, and the Hon. Sec. was requested to forward such resolutions to his widow and The Cryptogamic Society of Scotland. The election of officers for the ensuing year then took place. Mr. R. H. Biffen, M.A., was unanimously elected President; Professor H. Marshall Ward, D.Sc., F.R.S., &c., Vice-President; and Mr. Carleton Rea, B.C.L., M.A., Hon. Secretary and Treasurer. The Hon. Secretary and Treasurer announced that two ordinary members had been elected since their last meeting, viz., B. S. Ogle, Hill House, Steeple Aston, Oxford, and Miss Agnes Fry, Failand House, Failand, near Bristol, and that the sum of £23. 4s. 6d. stood to their credit at the Post Office. The date for the foray at Haslemere in 1905 was left to be arranged so as to suit the convenience of the President elect and "The Haslemere Microscope and Natural History Society."* Several suggestions for the place of meeting for the 1906 foray were discussed but no decision was arrived at. A paper on "Recent Researches on Parasitism" by R. H. Biffen, M.A. (see p. 84), was then read.

On Wednesday, the 14th of September, the members were busy up till 11.40 in examining the fungi collected on the previous day and then at that time departed from the West Cliff Station for Sands End. Here they detrained and walked up to the entrance lodge of the Mulgrave Woods (permission to visit which had been kindly granted by the owner, the Rev. the Marquess of Normanby), where the members first spread out over some open pastures and then proceeded into the woods surrounding the Castle. Although a careful search was made, few fungi were boxed, the most noteworthy being *Mycena Iris* Berk., *M. cruenta* Fr. *Pluteus salicinus* Pers., *Eccilia atropuncta* Pers., *Inocybe mutica* Fr., and *Cortinarius (Phlegmacium) prasinus* Schaeff. On the return walk to Sands End fine examples of *Coprinus squamosus* Morg.† were found growing at the railway station at the base of a post. In the evening the annual club dinner was held at the Hotel Métropole, after which the members proceeded to the Club-room and debated Saccardo's "De diagnostica et nomenclatura mycologica," a translation of which is appended at p. 80, and the resolutions in respect to those suggestions are there set out in full.

On Thursday, the 15th of September, the members took the 10 o'clock train from the Town Station to Sleights and proceeded through Iburndale to the woods near the Falling Foss. Here

* This has now been arranged and is fixed for Monday to Saturday, 25th to 30th September.

† For description see Trans. Brit. Myc. Soc. vol. I., p. 158.

the members separated, some walking over the moors to Robin Hood's Bay, whilst others caught the return train at Ruswarp. The most interesting specimens collected during the day included *Amanita porphyrea* A. & S., *Mycena haematopus* Pers., *Nolanea papillata* Bres. (New to Britain), *Pluteus nanus* Pers., *Inocybe Godeyi* (Gillet) Mass., *Paxillus giganteus* Fr. and *Hygrophorus unguinosus* Fr. The Rev. W. L. W. Eyre sent by post to the meeting two nice examples of the somewhat rare *Amanita Vittadinii* Morett. In the evening, at the Club-room, Mrs. Rea exhibited some paintings* of fungi which were recent additions to the British Fungus Flora, viz., *Inocybe brunnea* Quél and *Inocybe fulvella* Bres. described on page 64 of the last number of The Transactions. *Inocybe Godeyi* (Gillet) Mass. which exactly agreed with the description of this species as defined by Mr. Massee in his recent "Monograph of the genus Inocybe" in the Annals of Botany (July) 1904, p. 481. A new *Tricholoma*, which her husband had ventured to name *horribile* Rea. and *Lycoperdon depressum* Bon. and dried specimens of this last were handed round for inspection.

On Friday, the 16th of September, the members devoted the morning to investigating the previous day's material and then they took the 1.40 train from the Town Station to Goathland. A short walk through the village soon brought the members to the woods near Mallyans Spout, where fungi were found in some abundance and regret was expressed that time did not allow of a more prolonged search. Amongst the most noteworthy we may enumerate *Mycena dissiliens* Fr., *Cortinarius (Telamonia) armillatus* Fr., *Hygrophorus turundus* Fr. var. *mollis* B. & Br. and *Boletus tenuipes* Cke. In the evening, at the headquarters, a paper entitled "Eriksson's recent researches on the vegetative life of the cereal rust fungi" was read on behalf of C. B. Plowright, M.D. (see p. 76).

On Saturday, the 17th of September, most of the members departed homewards, but a few visited the neighbourhood of Robin Hood's Bay and walked over the moors and through the woods to Flying Hall Station, securing on the way specimens of *Marasmius Hudsoni* Fr. and *Nectria coccinea* (Pers.) Fr. Miss A. Lorrain Smith, F.L.S., subsequently reported the discovery of a new variety of a mould hitherto unknown in Britain, namely, *Mortierella pilulifera* van Tiegh. var. *parvispora* A. L. Sm., which she fully describes at page 92. Over 340 specimens of fungi were collected during the foray, which may be regarded as satisfactory considering the unfavourable conditions of the ground worked.

* See plates 7, 8, and 9.

COMPLETE LIST OF FUNGI GATHERED DURING THE FORAY.

Amanita virosa Fr., phalloides Fr., mappa Fr., porphyria A. & S., muscaria Linn., rubescens Pers., spissa Fr.

Amanitopsis vaginata Bull., strangulata Fr.

Lepiota cristata A. & S., granulosa Batsch, amianthina Scop.

Armillaria mellea Vahl.

Tricholoma flavobrunneum Fr., albobrunneum Pers., rutilans Schaeff., terreum Schaeff., saponaceum Fr., cuneifolium Fr.

Clitocybe nebularis Batsch., clavipes Pers., infundibuliformis Schaeff., geotropa Bull., metrachroa Fr., ditopus Fr., fragrans Sow.

Laccaria laccata (Scop.) Berk.

Collybia radicata Relh., fusipes Bull., maculata A. & S., butyracea Bull., vertirugis Cke., confluens Pers., cirrhata Schum., tuberosa Bull., acervata Fr., dryophila Bull., ambusta Fr.

Mycena pura Pers., luteoalba Bolt., lactea Pers., rugosa Fr., galericulata Scop., polygramma Bull., dissiliens Fr., alcalina Fr., ammoniaca Fr., filopes Bull., Iris Berk., haematopus Pers., cruenta Fr., sanguinolenta A. & S., galopus Pers., leucogala Cke., clavicularis Fr., tenerrima Berk.

Omphalia umbellifera L., grisea Fr., fibula Bull., var. Swartzii Fr.

Pluteus cervinus Schaeff., salicinus Pers., nanus Pers.

Entoloma lividum Bull., porphyrophaeum Fr., jubatum Fr., sericellum Fr., clypeatum Linn., rhodopolium Fr., sericeum Fr., nidorosum Fr.

Clitopilus prunulus Scop.

Leptonia anatina Lasch., lampropus Fr., incana Fr.

Nolanea pascua Pers., mammosa Linn., papillata Bres., picea Kalch.

Eccilia atropuncta Pers.

Pholiota erebia Fr., togularis Bull., radicosa Bull., squarrosa Müll., mutabilis Schaeff., marginata Batsch.

Inocybe hystrix Fr., lanuginosa Bull., cincinnata Fr., pyriodora Pers., mutica Fr., Godeyi (Gillet) Mass., rimosa Bull., asterospora Quél., geophylla Fr.

Hebeloma fastibile Fr., crustuliniforme Bull., longicaudum Pers.

Flammula tricholoma A. & S., carbonaria Fr., sapinea Fr., scamba Fr.

Naucoria badipes Fr., sobria Fr., escharoides Fr.
Galera tenera Schaeff., hypnorum Batsch.
Tubaria furfuracea Pers., paludosa Fr., stagnina Fr., crobula Fr., inquilina Fr.
Agaricus arvensis Schaeff., campestris L., haemorrhoidarius Kalch.
Stropharia aeruginosa Curt., albocyanea Desm., stercoraria Fr., semiglobata Batsch.
Hypholoma sublateritium Schaeff., capnoides Fr., epixanthum Fr., fasciculare Huds., dispersum Fr., pyrotrichum Holmsk., velutinum Pers., appendiculatum Bull., hydrophilum Bull.
Psilocybe subericea Fr., semilanceata Fr., var. caerulescens Cke., foenisecii Pers.
Psathyra corrugis Pers., fibrillosa Pers.
Anellaria separata (Linn.) Karst.
Panaeolus sphinctrinus Fr., campanulatus L.
Psathyrella gracilis Fr., hiascens Fr., atomata Fr., disseminata Pers.
Coprinus comatus Fr., atramentarius Fr., squamosus Morg., niveus Pers., lagopus Fr., cinereus Schaeff., micaceus Bull., radiatus Fr., plicatilis Curt.
Bolbitius vitellinus Pers.
Cortinarius (Phlegmacium) largus Fr., multiformis Fr., purpurascens Fr., prasinus Schaeff., decoloratus Fr.
(Myxacium) mucifluus Fr., elatior Pers.
(Inoloma) pholideus Fr.
(Dermocybe) tabularis Fr., caninus Fr., sanguineus Wulf., cinnamomeus Linn., and var. semisanguineus Brig.
(Telamonia) torvus Fr., armillatus Fr., hinnuleus Sow., hemitrichus Pers., paleaceus Weinm.
(Hydrocybe) bicolor Cke., leucopus Bull.
Gomphidius glutinosus Schaeff., viscidus L., gracilis Berk.
Paxillus giganteus (Sow.) Fr., involutus Batsch.
Hygrophorus eburneus Bull., cossus Sow., pratensis Pers., virgineus Wulf. and var. roseipes Mass., niveus Fr., laetus Pers., vitellinus Fr., ceraceus Wulf., miniatus Fr., turundus Fr. var. mollis B. & Br., obrusseus Fr., intermedius Pass., conicus Scop., calyptraeformis B., chlorophanus Fr., psittacinus Schaeff., unguinosus Fr.
Lactarius torminosus., Schaeff., turpis Weinm., pubescens Schrad., blennius Fr., pyrogalus Bull., chrysorheus Fr., pergamenus Sw., vellereus Fr., deliciosus Linn., pallidus Pers., quietus Fr., aurantiacus Pers., vietus Fr., rufus Scop., glyciosmus Fr., fuliginosus Fr., volemus Fr., serifluus DC., mitissimus Fr., subdulcis Bull.

Russula nigricans Bull., adusta Pers., densifolia Secr., chloroides (Kromb.) Bres., furcata Pers., rosacea Pers., virescens Schaeff., lepida Fr., rubra Fr., xerampelina Schaeff., vesca Fr., cyanoxantha Schaeff., galochroa Fr., consobrina Fr., foetens Pers., fellea Fr., emetica Harz., fallax Schaeff., ochroleuca Pers., fragilis Pers., citrina Gillet, nitida Pers., puellaris Fr., lutea Huds.

Cantharellus cibarius Fr., aurantiacus Wulf., tubaeformis Fr., infundibuliformis Scop.

Nyctalis parasitica Bull.

Marasmius peronatus Bolt., oreades Bolt., erythropus Fr., ramealis Bull., rotula Scop., androsaceus L., Hudsoni Pers., epiphyllus Fr.

Lentinus cochleatus Fr.

Lenzites betulina L.

Boletus luteus L., elegans Schum., flavus With., flavidus Fr., granulatus L., tenuipes Cke., badius Fr., variegatus Swartz., chrysenteron Bull., subtomentosus L., edulis Bull., laricinus Berk., scaber Fr. var. aurantiacus Bull., versipellis Fr., felleus Bull.

Polyporus squamosus Fr., giganteus Fr., hispidus Fr., rutilans Fr., betulinus Fr., adustus Fr.

Fomes annosus Fr.

Polystictus versicolor Fr., abietinus Fr.

Poria mollusca Fr., vaporaria Fr., blepharistoma B. & Br.

Hydnum repandum L. and var. rufescens Pers. farinaceum Pers.

Irpex obliquus Schrad.

Grandinia granulosa Pers.

Stereum hirsutum Willd., rugosum Pers.

Hymenochaete rubiginosa Lév.

Clavaria muscoides L., cinerea Bull., cristata Pers., rugosa Bull., inaequalis Fl. D., vermicularis Scop., tenuipes B. & Br.

Calocera viscosa Pers.

Auricularia mesenterica Fr.

Tremella mesenterica Retz.

Scleroderma vulgare Fr., verrucosum Pers.

Sphaerobolus stellatus Tode.

Lycoperdon saccatum Vahl., gemmatum Batsch, pyriforme Schaeff., perlatum Pers., nigrescens Vitt.

Ithyphallus impudicus Fisch.

Mutinus caninus Fr.

Cephalosporium acremonium Corda.

Botrytis cinerea Pers.

Torula antennata Pers.

Trichosporium fuscum Sacc.

Zygodesmus fuscus Corda.

Haplographium chlorocephalum Grove.

Steganosporium pyriforme Corda.
Sphaeronemella fimicola March.
Nectria coccinea (Pers.) Fr.
Cordyceps ophioglossoides Fr.
Podospora decipiens (Wint.)
Sporormia minima Auersw.
Melanomma Pulvis pyrius Fckl.
Hypoxylon effusum Nke.
Mucor mucedo Pers.
Pilobolus crystallinus Tode.
Mortierella pilulifera van Teigh. var. parvispora A. L Sm.
Dictyostelium mucoroides Bref.
Ascobolus vinosus Berk.
Saccobolus neglectus Boud.
Helotium claroflavum Berk.
Ciboria ochroleuca Mass.
Lachnea hirta Gillet, scutellata Gillet, hemispherica Gillet.
Neottiella polytrichi Mass.
Humaria granulata Sacc.
Peziza succosa Berk.
Otidea aurantia Mass.
Leotia lubrica Pers.
Elaphomyces variegatus Vitt.

*Mycetozoa**

Physarum nutans Pers. γ leucophaeum.
Didymium nigripes Fr. α genuinum.
Comatricha typhoides Rost. α genuina.
Tubulina fragiformis Pers.
Arcyria incarnata Pers.

*These determinations were kindly confirmed by Mr. A. Lister, F.R.S.

ERIKSSON'S RECENT RESEARCHES ON THE VEGETATIVE LIFE OF THE CEREAL RUST FUNGI.*

By Charles B. Plowright, M.D.

In the present communication the author points out that since the 'sixties, when De Bary made public his work on the life-history of the three common Pucciniae parasitic upon the cereals of Europe, continued experimental researches have shown that these three species consist in reality of no fewer than twelve. He further indicates that De Bary's work, important and accurate as it was, deals with the three species then known as *P. graminis*, *straminis*, and *coronata*, in which he showed their relationship to the three common Æcidia on Barberry, Anchusa and Rhamnus. It did not afford an explanation of the manner by which in large areas of country the crops are simultaneously attacked by these rust and mildew parasites. He emphasises the fact so well known to those who study fungi in the field, that the area of infection does not extend much beyond 50 or 60 yards from a Barberry or Buckthorn bush. He further urges again that his hypothesis of a mycoplasmic symbiosis existing between the fungus and the host-plant explains the widespread dissemination of these parasites better than any other. His view is that this "mycoplasm" exists as a form of protoplasm (see Fig. A.) within the cells of the host, which can be demonstrated in those varieties of Wheat that are speciallysubject to the parasite, as soon as the first green leaf appears above ground. That this mycoplasm lives symbiotically in the tissues of the plant until such time as favourable conditions, climatic and other, cause it to pass into the typical mycelial stage from which the spore-beds of the Uredo are formed. If this can be shown to be the case, an explanation of those sudden and widespread outbreaks of Wheat-mildew which sometimes occur in England and the annual decimation which Wheat-rust causes in Australia and other countries become explicable, and, what is of infinitely more importance, it would give us a clue as to what lines on which we should fight the disease.

* (*Uber das Vegetative leben der Getreiderostpilze*, Jakob Eriksson. I. Puccinia glumarum von Jakob Eriksson und Georg Tischler with three coloured plates; 4to. 1904. Stockholm: P. A. Norstedt & Sons. London: William Wesley & Son, 28, Essex Street, Strand.)

The hypothesis is by no means an unthinkable one, but its mere plausibility must not make us accept it. In the first place it is new, and we cannot cast off our old views at a moment's notice. Then again we have seen the mycelium, but we have not—most of us, at any rate—ever seen this mycoplasm. Eriksson has selected for its demonstration certain varieties of Wheat which are year by year affected in Sweden with *Puccinia glumarum*, notably Horsford's Pearl Wheat. Some of it was sown in October, 1902, and when the seedlings had attained a height of

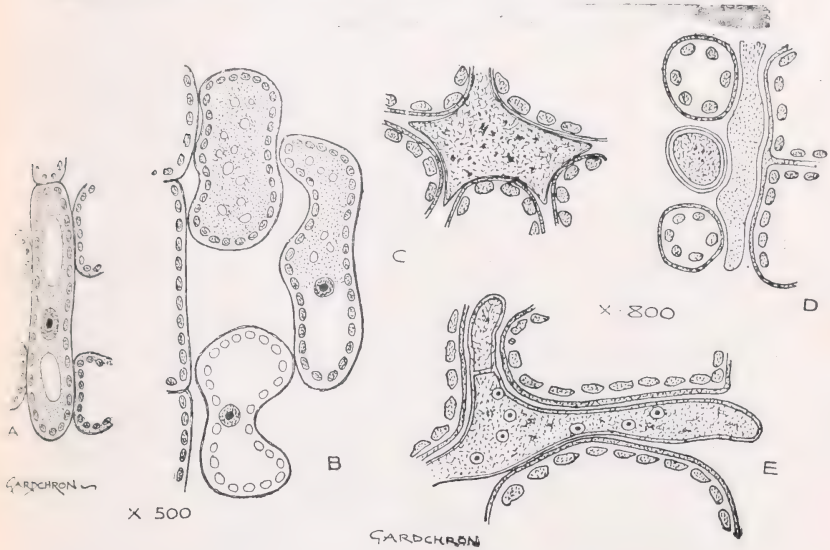


FIG 1*—A TO E, SHOWING THE MYCOPLASM FROM ERIKSSON'S FIGURES, TABB. I.—III.

A—*Tab. i., f.* 2, *b.*—Cell of Wheat seedling with mycoplasmic contents containing two vacuoles.

B—*Tab. i., f.* 5.—Three cells of little older seedling, showing one cell filled with mycoplasm, another partially filled, and the third quite devoid of it.

C—*Tab. ii., f.* 11, *c.*—Mass of mycoplasm between the cells of Wheat leaf in the month of July, taken from the periphery of an area containing sori of Uredo glumarum. About 4-6 mm. beyond the outer sori, the mass fills the interspace between five cells and is sending prolongations between them.

D—*Tab. ii., f.* 11, *a.*—Extension of plasm between the cells' granular contents more obvious, including membrane scarcely apparent.

E—*Tab. iii., f.* 14.—Further stage, the mass of mycoplasm has become invested with a distinct membrane, of which the double contour is apparent; one septum has formed. Clearer area is seen around some of the larger granules.

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35 or 40 mm., which was in twenty-three days from the date of sowing, a portion of the first green leaf of one of them was examined. Various fixing solutions were employed in these experiments, such as Flemming's chrom-osmium-acetic acid, Hermann's platinochloride mixture, absolute alcohol, &c.; while for stains Flemming's saffranin - gentian - violet - orange -, and fuchsinmethylgreen were made use of.†

The accompanying figure (fig. 1, A), reproduced from Eriksson's plate 1, fig. 2, *b*, shows what he saw. A cell of the host-plant whose nucleus has stained red is filled by mycoplasmic material, in which two large vacuoles are seen one above the other below the nucleus.

Fig. 1, B, t. i., f. 5, shows three cells from a little older seedling (forty-four days after sowing), in which the second green leaf was unfolding. The upper cell is seen to be filled by mycoplasm, the middle half filled, and the lowermost quite devoid of it. Many hundreds of sections have been cut by the authors, of which only a certain number show the mycoplasm present. When present, it is found to fill more or less of the lumen of the cells, and to contain granules, which are coloured pale-violet by Flemming's staining reagent, and dark blue by Heidenhain's haematoxylon. Eriksson regards it as being something intermediate between ordinary protoplasm and typical fungus-protoplasm. Sections of leaves from plants of Bromus inermis and Festuca arundinacea, which have been under observation for many years, and which had had no Uredo upon them for certainly the last ten, showed no mycoplasm. Neither could it be found in those varieties of Wheat which are seldom attacked by *Uredo glumarum*, notably Bart Trimenia, Medeah, and Madonna.

The existence of a fungoid parasite in the tissue of its host in the form of a plasma is not a new fact, or one confined to the cereal Uredines. The well-known instance of Plasmodiophora will at once suggest itself. Pseudocommis, again, about which such a copious literature has sprung up during the last few years, affords another instance. With this, however, it has been suggested some of these bodies may be products made by the action of the reagents employed, and that they are tannin and its derivatives. Still, whatever may be the case with Pseudocommis, which for the most part occurs late in the life of the cells of the plant, one would hardly expect to find tannin in the first green leaf of a cereal.

More recently, Zukal speaks of finding "amœboid plasmatic bodies" in the cells of living Barley-leaves, in his work on the Rust-diseases of the cereals of Austria-Hungary, as quoted by

† The various solutions are given in the paper, p. 7.

Eriksson. The observations of René Maire, in the *Bulletin de la Société Mycologique de France*, 1901, with regard to the life-history of Endophyllum sempervivi, are also to the point.

With regard to *P. glumarum*, no mycelium is developed until the following summer, in the month of July, when the Uredo spores are formed. Sections taken from an affected leaf 4 to 6 mm. beyond the most external spore-bed, and treated in the same manner, show the mycelium to consist at first of masses of granular mycoplasm between the cells of the plant (fig. 1, c, t. ii., f. 11, *c*). From these masses outgrowths take place which force their way among the cells (fig. 1, D, 2, f. 11, *a*). At first the granules are very small, but they soon increase in size. These elongated masses become invested by a very delicate membrane which thickens and eventually acquires a double contour. Septa now appear, and some of the granules become surrounded by a clearer area. These changes are shown by t. ii., f. 11, *a*, where an elongated mass is seen extending between the cells. Fig 1, E, t. iii. f. 14, shows a later stage, in which a double contoured membrane has invested such an extension. The granules are larger, many of them surrounded by clearer areas, and septation has commenced.

More recently (*Comptes Rendus*, July 4, 1904), Eriksson has confirmed the above results with two or three species, viz., the crown rust of Rye (*P. dispersa*), and the yellow rust of Barley *P. glumarum f. Hordei.* With these he finds an extension of the plasmic masses takes place not only between the cells of the host plant, but, like other forms of protoplasm, it often occurs from cell to cell through the normal openings which exist in the cell walls. Thus those endohaustoria are produced in the cells, which he has designated special corpuscles. The fact that a parasitic fungus can exist in a protoplasmic form in the tissues of its host and only develop mycelium and spores under certain conditions of environment is an extremely important one and one which, if proved, will explain some of the unsolved mysteries connected with the life-history of the Potato disease, not to mention other epidemic plant diseases. That the subject is one worthy of study is shown by the fact that our distinguished Vice-President, Professor Marshall Ward (than whom no one is better able to elucidate the whole question), has undertaken a series of investigations with regard to it.—*King's Lynn, September* 14, 1904.

DE DIAGNOSTICA ET NOMENCLATURA MYCOLOGICA; ADMONITA QUAEDAM.

SACCARDO

I. "Authors of new species, who describe them at length both morphologically and biologically, should append diagnoses of them in the usual form, in English, French, German or Italian, but above all, if it be possible, in Latin. The scattered and often incomplete statements of essential characters are found only with difficulty in the long and frequently formless descriptions. In consequence, the diagnoses available for systematic compendia are often vitiated, entirely through the fault of the original authors."

Approved but add that the essential differences between allied species should be emphasized and distinguished.

II. "The host plants of fungi shall be designated by their Latin names, and not by vernacular names in English, Italian, &c., which are often of doubtful meaning.

"It is of the utmost importance that every author should indicate the matrix, or host plant, particularly of parasitic fungi."

Approved but add that in the case of non-parasitic fungi the kind of wood or nature of the soil should be designated if possible and in the latter case the kind of surrounding vegetation, *e.g.*, dead elm stump, under oaks on calcareous soil, &c.

III. "The metric system alone shall be used in indicating measurements. When these are small, the micromillimeter should be employed. Fractions of millimeters, or other measurements, burdened with marks or signs, are ready sources of error."

Approved.

IV. "For the sake of brevity, the sign ⁄, already in use since 1872, should be employed between figures indicating the extremes of length and width of microscopic organs, in place of the sign ×, =, :, which are made use of by mathematicians in another sense."

Dissented from and resolved that the use of the old Saint Andrew's Cross be maintained as having received the sanction of intelligible usage, and that the sign ⁄, would be almost unintelligible to ordinary botanists.

V. "When a specific name is transferred to another genus, the original author is cited in parenthesis (a practice earnestly to be commended), while the author of the new combination is also to be cited. Example: Winter wrote *Sphaerella convexula* (Schw.), omitting the author of the combination. But this is a misleading citation, as the reader can make of it either *Sphaerella convexula* (Schw.) Wint., or *Sphaerella convexula* Wint.: both citations are erroneous, as the proper one is *Sphaerella convexula* (Schw.) Thüm."

Approved subject to the favourable reception of rules IX., X., XI., and XII.

VI. "Names of systematic divisions should be written uniformly in the feminine gender, as the word *plantae* is understood. This has the sanction of the best usage. We often find in succession: *Euthallophyta . . . Phycomycetes . . . Mucoraceae.* These would be much more correctly written: *Euthallophytae . . . Phycomycetae . . . Mucoraceae.*"

Approved.

VII. "The following terminology for the receptacles, spores, &c., of fungi is recommended, in order that there may be as much uniformity as possible—

Hymenomycetae: pileus (whatever the form); basidia; sterigmata; sporae; cystidia.

Gasteromycetae and *Myxomycetae*: peridium; gleba; capillitium; flocci; sporae.

Uredinaceae: sorus; teleutosorus; uredosorus; teleutosporae; mesosporae; uredosporae; pseudoperidium; aecidiosporae; caeomosporae; epiteosporae.

Ustilaginaceae: sorus; sporae.

Phycomycetae: oogonia; oosporae; antheridia; sporangia; zygosporae; azygosporae; zoosporangia; zoosporae; conidiophora; conidia.

Pyrenomycetae and *Phymatosphaeriaceae*: stroma; perithecium; loculus; ascus; sporidia; paraphyses.

Discomycetae and Tuberoideae: ascoma; gleba; ascus; sporidia; paraphyses.

Schizomycetae: filamenta; baculi; cocci, endosporae; arthrosporae.

Sphaeropsidaceae: stroma; pycnidium; basidia; sporulae.

Melanconiaceae: acervulus; basidia; conidia (not gonidia, which are altogether different, and belong to the Lichens).

Hyphomycetae: caespitulus; sporodochium; hyphae; conidiophora; conidia.

Obs. From the spore, in the broad sense, arise by germination a promycelium, which produces sporidiola (not sporidia, as many say)."

Approved subject to the following alterations. Myxomycetae should be expunged in favour of the term Mycetozoa which more nearly indicates the doubtful nature of these organisms. Omit flocci under Gastromycetae. To Phycomycetae add sporangiophora, and columella. In Discomycetae use spore instead of sporidia. And in Sphaeropsidaceae and Melanconiaceae omit basidia.

VIII. "Fungi imperfecti, or *Deuteromycetae*, are to be cited and described along with their perfect stages (if these are clearly indicated). They should also be described separately in systematic works under their own name and with their form relatives, or at least cited there, with a reference to the place where they are described with the perfect forms.

"The advantage of describing separately all the forms of imperfect fungi arises from the fact that we are entirely ignorant of the perfect stages to which the vast majority of this immense group belong, and that these forms are for the most part widely removed from the perfect stage, whence the great difficulty of determining whether one form or another has already been described (without a name) under its perfect stage. From this rule should be excepted species of the genus *Uredo*, which are most frequently associated with the teleutospore stage (*Uromyces*, *Puccinia*, &c.), with which alone they should be described. But species of *Aecidium*, *Epitea*, *Caeoma* and *Aecidiolum* are to be described or at least cited separately. Conidial stages of *Peronospora* and *Cystopus* are to be described but once, in connection with the perfect stages."

Approved.

IX. "The names of fungi which do not show metagenesis should conform to the rules of nomenclature for other plants, but the metagenetic *Uredinaceae* and *Ascomycetae* should follow especial rules."

Approved.

X. "The proper name of one of the *Uredinaceae* is that applied to the teleutospore stage, the secondary name is that given to one of the earlier stages (*Uredo*, *Epitea*, *Caeoma*, *Aecidium*, *Aecidiolum*). Moreover, when the name of an earlier stage of any species is found to have been published before the name of the correlated perfect stage, it is not permissible to transfer the name of the imperfect stage to the perfect one upon

the plea of priority, unless the former is found to comprise the perfect stage also, as often happens in *Uredo*, with respect to species of *Uromyces*, *Puccinia*, *Coleosporium*, &c. When we wish to transfer the name Aecidium to the teleutospore stage, as formerly permitted, we act directly contrary to the facts. Of many examples, two will suffice. 1, When we change the name *Puccinia Caricis* Reb. (1804) to *P. Urticae* (Schum.) Lagerh., because the name of the aecidial stage (*Aecidium Urticae* Schum., 1803) is earlier, we make two misstatements, namely, that Schumacher knew and distinguished *Puccinia Caricis*, which he did not, and that this Puccinia grows upon *Urtica*, which nourishes no *Puccinia*. 2, When we change the name of the extremely common *Puccinia graminis* Pers. (1797) to *Puccinia poculiformis* (Jacq.) Wetts, because the name of the aecidium is prior (Lycoperdon poculiforme Jacq. 1783), we likewise make two false statements, namely, that Jacquin knew and distinguished *Puccinia graminis*, and that this assumes the form of a cup, a form which it does not exhibit."

Approved.

XI. "As to the heteroecious species of *Uredinaceae* recently distinguished, the names proposed by Klebahn, Arthur, and others, based upon the two hosts, merits approval; with this condition, however, that the specific name be composed of not more than two words, and that the host of the teleutospore stage hold first place in the name, the host of the aecidium second place. Thus: *Puccinia Pseudocyperi-Ribesii*, not *P. Ribesii Pseudocyperi* Kleb. *Melampsora Populina-Allii*; not *M. Allii-Populina* Kleb.

Approved.

XII. "What has been said of the nomenclature of *Uredinaceae* is valid for *Ascomycetae*. Thus, for example, it is incorrect to write *Glomerella rufo-maculans* (Berk.) Schrenk & Spaulding, because the conidial stage is *Septoria* (*Gloeosporium*) *rufo-maculans* Berk. (1854), as Berkeley neither saw nor described the ascus bearing stage. It is, however, correct to write *Glomerella fructigena* (Clinton) Sacc., for the ascophore is *Gnomoniopsis fructigena* Clinton 1902."

Strongly approved because this addition will prevent a strict adherence to rule V. involving such an absurdity as placing *Ctenomyces serratus* Eidam under *Arthroderma Curreyi* Berk. (1854) and later E. S. Salmon, whereas neither Berkeley or Salmon knew it as an Ascomycete but considered it to be a Hyphomycete and it was subsequently republished as *Arthroderma Curreyi* by A. L. S. in the issue of these Transactions for 1903, p. 60.

XIII. "Adjectival specific names should agree in gender with the name of the genus. Hence the names *Glomerella cinctum* (B. & C.) Spauld. & Schr., *G. piperatum* (E. & Ev.) Spauld. & Schr., *Puccinia hibisciatum* (Schw.) Kell., thus formed because the imperfect stages are of the neuter gender (*Gloeosporium* and *Aecidium*), are to be rejected, as well as for the reason that the authors cited within parentheses knew only the imperfect stage, which is altogether different from the perfect. The name *Nummularia nummularium* (Bull.) Keissl. Krypt. exsicc. Vindob. no. 516 (1900) is likewise to be rejected, both on account of tautology and the difference in gender."

Approved.

RECENT RESEARCHES ON PARASITISM.

By R. H. Biffen, M.A.

The scientific study of parasitism dates from the year 1866, when De Bary's *Morphologie and Physiologie der Pilze*, etc., containing the results of researches carried out between the years 1853 and 1863, was published. With rare exceptions, amongst whom we must mention Berkeley and Kuhn, most authors before this period vaguely supposed that the parasitic fungi were the hypertrophied cells of the host plants or even their cell-contents such as chlorophyll grains. De Bary, by means of infection experiments, gave us in this work the first clues as to the actual relations of the host plant and the parasite, and marked out, once for all, the lines along which subsequent investigations have been carried out. Within the last forty years the experimental methods he adopted have been widely applied, with the result that our knowledge of parasitism has increased with a rapidity which on looking backwards is little less than amazing. Instead of an isolated worker here and there there are now many adding almost daily to our knowledge of the subject. We now have special journals devoted solely to the publication of their researches and, what is perhaps more remarkable still, the economic value of such studies has been realized and we are frequently in a position to combat the attacks of parasites on the wholesale scale.

Amongst all of the researches carried out in this period those of Eriksson embodied in his *Die Getreiderost*, 1896, stand out from all others and mark a fresh starting point second in importance only to De Bary's. This work has opened new and unexpected fields, which have already been worked with con-

siderable profit and give promise of still more valuable harvests to come. It may well serve us as a starting point in reviewing briefly the progress recently made.

Eriksson's primary object was to investigate the rusts of the cereal crops and determine whether anything could be done to check the enormous losses they cause year by year. There were some four species recognized by mycologists on the cereals wheat, barley, oats and rye, but Eriksson showed that in Sweden there were at least ten forms of rust to be reckoned with on these host plants. Taking, for instance, the single species *Puccinia graminis*, this was known on the various cereals and on a hundred of the native grasses and it was supposed that the fungus could pass indiscriminately from any one host to the other. By a long series of infection experiments Eriksson showed that this was by no means the case. If for instance the uredospores of *P. graminis* were taken from oat-plants they failed to reproduce the rust on rye, barley, or wheat; similarly if taken from meadow grass (*Poa pratensis*) they were incapable of infecting these same cereals. Thus this single species could be broken up into a series of races such as *P. graminis secalis*, *P. graminis tritici*, *P. graminis avenae*, *P. graminis poae*, etc., the infecting powers of which were confined to certain groups of plants. For the first time then we realized that the spreading of these parasites from wild to cultivated host-plants was not as widespread as we had believed, and it was also clearly proved that, with exceptions we need not describe here, the spreading from one cereal to another did not occur. These specialized forms of *P. graminis* have received various names. They are frequently described as "biologic species," for from a physiological point of view they are obviously distinct species, but systematists who can make use of external characteristics only for delimiting the species can hardly look upon them as such, as morphologically they are identical with one another. We may therefore compromise and call them "biologic forms."

The distinctness of these biologic forms is further emphasized by the fact that the aecidiospores they give rise to on the barberry have the same restricted powers of infection. If, for instance, the aecidiospores result from an infection with the form from wheat they are incapable of reproducing the rust on barley and so on.

Other researches have proved the accuracy of Eriksson's work and shown also that this specialization of fungi to particular host-plants is a phenomenon by no means confined to the rusts of the Gramineae but that it is probably of very general occurrence. Thus it is known in other Uredineae and in such Ascomycetes as *Claviceps*, *Exoascus* and *Erysiphe*. The researches of Neger, Salmon and Marechal have made our knowledge of the

biologic forms of the Erysiphe almost as complete as it is in the case of the rusts of the Gramineae. The widely distributed species *Erysiphe graminis*, for instance, has been shown to be an aggregate of distinct biologic forms. The form on wheat refuses to infect normally growing barley, that on barley (*Hordeum sativum*) will not infect *H. sylvaticum* and so on, and further they have proved to be as distinct from one another in the ascus stage as they are in the conidial stage.

In this particular direction we have reached closely to the limits of human knowledge, and looking beyond we can see more or less clearly that a closer study of this subject from a physiological point of view, will give us some clue as to the conditions obtaining both in the host plants and the parasites which have led to this singular separation of biologic forms within single species. In this connection the discovery of "bridging species" by Marshall Ward is of unusual interest. The experiments were carried out with a biologic form of *P. dispersa* occurring on various species of the genus Bromus, and resulted in the proof that the fungus might infect a host plant A but be incapable of infecting a second species B, yet B might be infected by spores of the same fungus produced on a third species C from a sowing of spores from A. The species C then acts, from the point of view of the fungus as a bridge between A. and B., enabling it indirectly to bring about infection where direct infection is impossible. Following this Salmon has proved that bridging species exist, again amongst the Bromes which permit of the indirect passage of a biologic form of *Erysiphe graminis* from one host to another where direct infection is impossible. The spreading of parasitic fungi is not so sharply restricted then between certain host-plants as at first sight it appeared to be. These results point to the fact that some change in the constitution of the parasite itself is brought about solely by its temporary sojourn on a different host plant since then it can bring about infection where it could not before. How this change is effected or what it really is we cannot say, for we know nothing of the factors determining constitution in either host or parasite. Further than this it has been shown by Salmon that under certain conditions a given biologic form can be induced to infect hosts normally perfectly immune to its attacks. This has been accomplished by lowering the vitality of groups of cells in the leaves of the plant by such drastic methods as bruising, cutting, burning, treating with anaesthetics and so on. After such treatment the injured portions of the leaves of barley become slightly susceptible to the attacks of *Erysiphe graminis* growing on wheat, in spite of the fact that the fungi on wheat and barley belong to sharply distinct biologic forms. The fungus is capable of getting such a hold on the

injured tissues that it can give rise to fresh crops of conidia, but these conidia are not capable of infecting normal barley foliage. Putting the matter crudely we may say that their temporary sojourn on barley has not sufficiently altered their constitution to make them capable of attacking it directly—it can still only respond to wheat, its normal host.

Such considerations show clearly that the plant itself when growing normally has a capacity for resisting the infection of certain parasites and they lead one to ask whether by changing the external conditions under which the plant is growing this power of resistance can be altered, whether it can be increased or diminished? If in any way it can be increased those whose mission it is to combat fungoid attacks will have a powerful weapon placed in their hands. So far though we have little evidence one way or the other. Marshall Ward has shown that the condition of the plant as determined by starving it of certain food materials such as phosphates, nitrates, calcium compounds and so on, does not alter its liability to infection, but Hennings states that plants highly susceptible to the attacks of certain parasites become far less so when transplanted into richer soils. On the other hand it is generally believed that wheat, for instance, grown on rich soil is more susceptible to yellow rust than when grown on poor soils. A probable explanation of the latter phenomenon is that the fungus has greater stores of foodstuffs to draw upon in the former case and can consequently produce far more spores and so become more obvious.

The whole subject is rendered more complex by the fact that it does not follow that because a plant, say for example wheat, can resist the attacks of yellow rust it is immune to the mildew as well.

When one seeks for an explanation of the fact that of two very similar plants one may be highly susceptible to the attacks of a particular fungus and the other immune, the answers given are conflicting. Speaking of wheat and its rusts a recent text-book considers immunity to be due to such external characteristics as toughness of the epidermis (though infection takes place through the stomata) and the narrowness and erectness of the leaf-blade. It also states that early sown and early ripening varieties escape rust best. At first sight there is a superficial probability that these factors are of importance but a more detailed examination shows that they fail to carry the burden required of them. The one extensive histological examination made for this purpose by Marshall Ward has shown that the possibility or otherwise of infection occurring among the species of Bromus when inoculated with uredospores of the biologic form of *Puccinia dispersa* could not be correlated with such

characters as thickness of cuticle, the number of stomata per unit area, the hairiness of the leaves, etc. I may also add that some of the most susceptible wheats to yellow rust are characterized by their early habit of ripening. The factors which determine whether a plant will be immune or susceptible to any particular fungus are at present beyond the reach of our powers of observation. They are intra-protoplasmic and infection experiments alone can decide the matter. Where such infection trials are made with the uredospores of a rust they are found to push out a mycelium into a stoma, which develops rapidly in the intercellular spaces and drives its haustoria into the cells of the susceptible host plant. In the immune plant the mycelium fails to develop to any extent in the intercellular spaces and finally it dies away altogether. At the outset the possibilities of infection are the same for each, but the fungus fail to overcome the resistance of the cell walls and protoplasm of the immune plant and consequently dies for lack of food before it can obtain a footing. Why it fails we cannot say and can only ascribe it again to the constitution of the host plant, leaving what are probably complex problems in the metabolism both of the host and parasite for the future to decide. It may be, as has been suggested, that antitoxins in the host and toxins in the parasite are the deciding factors. In this connection we may note in passing that claims have been made, which require supporting, that certain plants have been rendered immune to the attacks of their usual parasite by being watered with solutions of copper sulphate.

The next portion of the subject which requires investigation is the external conditions responsible for epidemics, for rust-years, for potato-disease years, etc., for knowing what to expect it may be that precautions can be taken for checking their ravages. In certain cases we know something of these external conditions. Thus it is now universally agreed that epidemics of potato-disease (*Phytophthora infestans*) occur when moist, dull weather, and consequently a water-saturated atmosphere, follow a forcing period of growth in July and August. Such conditions one can readily realize are peculiarly favourable for the rapid development and distribution of the zoospores of the fungus, whilst it is possible that they, to a certain extent, break down the host-plant's capacity for resistance by disturbing its normal economy. One need only remember that under such conditions the plant would tend to become water-logged, owing to imperfect transpiration, to see how such disturbances would be possible. That the same external conditions are favourable to the spread of all parasitic fungi is highly improbable. A rust-epidemic and a mildew-epidemic are not necessarily found in the same season on a barley crop, though these fungi make

their appearance at the same time and are consequently exposed to the same external conditions. Generally the barleys suffer from mildew one season, and rust another, but we have not sufficient data so far to forecast which will be the more serious pest. Eriksson, to explain certain facts in connection with epidemics of yellow rust has been led to formulate his much-discussed "mycoplasm" hypothesis. The essential points of this are that the wheat grains themselves contain within some of their cells a portion of the protoplasm of the yellow rust. This fungus protoplasm, or mycoplasm, lives for a time symbiotically with its host, but under certain external conditions it is supposed to be capable of further development, resulting in the production of the mycelium and finally of the spores of the rust. This conception of the handing on directly from the maternal parent to the offspring of the actual cause of disease has not met with general acceptance. It runs counter to all one's knowledge of heredity and one may now dismiss the subject, for it has been shown that Eriksson when attempting to demonstrate the actual mycoplasm and its development was misled, largely by faulty technique.

We may say definitely that we know of no well authenticated case where disease can be transmitted in this way, but we do know definitely that the tendency or the liability to disease is inherited, and, that given suitable conditions, the plants will certainly become diseased. Many examples might be quoted but I must content myself with a few. If we take four barleys, *Hordeum spontaneum*, *H. violaceum*, *H. japonicum*, *H. hexastico-furcatum*, and keep them under observation season by season, the first will be found practically immune to the attacks of *Erysiphe graminis*, whilst the remaining three will show gradually increasing degrees of virulence in the attacks of the parasite in the order quoted. In the same way wheats such as Engrain commun are always practically rust free, whilst Michigan Bronze is badly infected. Such facts bring us back once more to the "constitution" of the plant. Some, from this point of view, are sound, others are wanting, and we look forward to the time when we shall be able to say why this should be so and give those who are responsible for our crops further aid in, what is rapidly becoming a pressing problem, the raising of disease-resistant races.

CORTICIUM (PENIOPHORA) CHRYSANTHEMI

By Charles B. Plowright, M.D.

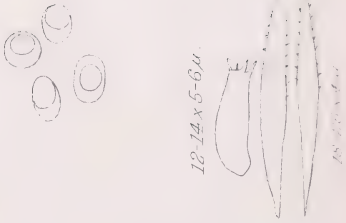
With Plate 6.

Some five-and-twenty years ago I planted a number of Chrysanthemum plants on the south side of a wall in a small strip of freshly broken up garden ground in King's Lynn. Chrysanthemums in those days were not what they are now and the varieties planted were intended to be permanent ornaments, of the garden. In the course of a few years they died off, one after another. On examination of the plants it was observed that in each case a white fungus growth was present on the lower part of the stems. This growth resembled a splash of whitewash. It was not confined to the stems but extended into the adjacent soil. At first it was regarded as some form of white mould of a saprophytic nature, for at that time but little was known of the parasitic character of the Hymenomycetes. For several years attempts made to grow Chrysanthemum plants in this garden failed. Closer examination and more careful watching made it evident that the fungus was a Corticium bearing a close external resemblance to *C. sambuci*. Its fullest development was attained upon the base of the stems. It never extended far upwards above the ground level and it was noted that the white hyphæ not only matted the particles of earth together but that they extended in many cases from stem to stem. Plants once attacked did not survive beyond the second year.

The young green shoots sent up by affected plants in the autumn are shorter in height and thinner in the stem. Experience shows that when once a plant is attacked it is of little use attempting to remove the healthy portions and induce them to grow for the ensuing season's blossoms. They almost invariably succumb within the year. During the autumn of 1904 the disease was met with in two other gardens in the town, which led to its more careful examination, as a fungus of such destructive capabilities cannot fail to be interesting to horticulturists.

The stroma of the hymenophore is lax, the individual hyphæ being easily demonstrated in a section, especially upon its lower surface. When growing in living bark they can be seen to pass between the cells of the host.

The hymenium is smooth to the unaided eye but irregular



Basidium and Cystidia.

Spores 5-6 x 4-5 μ.

C.B.P.& E.A.R. del.

West, Newman chromo London

Corticium (Peniophora) Chrysanthemi *Plow.*

owing to the unevenness of the matrix. A microscopic section shows it to be thickly studded with cystidia. Most of the cystidia are surmounted by a globular apical expansion 2 to 3 μ across. The whole cystidium averages from 20 to 25 μ in length, from 10 to 15 μ of which project above the surface of the hymenium. The basidia are peculiar in shape, being much flatter above where they bear four, rarely two, sterigmata. The whole basidium measures from 12 to 15 μ in length by 5 to 6 μ in diameter. The spores are colourless, oval, 5-6 × 4-5 μ, with large, very apparent nuclei.

The capitate cystidia, the flat-topped basidia and the large nuclear spores render this species easy of recognition microscopically. To the naked eye the dead white hymenium on the living and dead stems at their ground level, the matting of earth by the hyphæ of the fungus, and the attenuated shoots of the affected plants show the gardener at once what he has to deal with. The only treatment is burning the diseased plant. It is useless to separate the apparently healthy shoots.

Specimens of the fungus have been deposited in the Herbarium of the British Museum and have been placed next Peniophora terrestris Mass.

Corticium (Peniophora) Chrysanthemi.

Hymenium chalk white, effused, incrusting, indeterminate, uneven from the irregularities of the matrix, substratum filamentous. Spores hyaline, oval with large nuclei 5-8 × 3-5 μ. Basidia flattened at the summit 10-15 × 5-6 μ, bearing four, rarely two, sterigmata. Cystidia numerous, 18-25 μ × 4-5 μ, projecting from 10-15 μ above the surface of the hymenium with a spherically dilated apex about 3 μ in diameter.

Parasitic at the base of living Chrysanthemum stems, autumn.

NOTES ON THREE UNCOMMON FUNGI.

By Cecil H. Sp. Perceval.

Agaricus (Pleurotus) corticatus Fr.

On dead beech at top of the Dene Lane, Longwitton, Nov. 1902 and 1904.

Agaricus (Pleurotus) serotinus Sch.

On dead horsechestnut in Longwitton Garden House field, Nov. 13, 1904.

Polyporus umbellatus Fr.

On the ground, in a wood on the north bank of River Hart, on the N. side of footpath, a little to the E. of the gully out of the Wittonstone field, Longwitton, 26 August, 1904. It was also found by me, at the same place several years ago, when I failed to identify it. Although I have often looked for it since, at the same place, I have never seen it again until last August. These are the only two specimens I have ever met with. It grows in a cluster of roundish outline reminding one at the first glance of *Sparassis crispa*. It is very brittle, and very soon perishes. On each occasion I sent the specimen away by post, the day after I found it, and each time it arrived like a handful of wet sawdust.

The pileoli are rather scaly, very much waved, and thin; the pores extend all down the stem, and are variable in form, here and there elongated.

The spores have much the same outline as that of a grain of wheat.

FUNGI NEW TO BRITAIN.

By Annie Lorrain Smith, F.L.S., and Carleton Rea, B.C.L., M.A., &c.

WITH PLATES VII., VIII. & IX.

Mortierella pilulifera van Tiegh. Ann. Sci. Nat., Series 6, Vol. I., p. 105, tef. 11, figs. 63-69.

Sporangiophores solitary, upright, unbranched, septate when mature, especially towards the base, surrounded at the base with short swollen terminal hyphae at first filled with protoplasm, then empty and brown-walled; 5 mm. high, cylindrical, slightly swollen at the base and slightly broader beneath the sporangium, colourless, and stiff; sporangia globose always colourless, poly-spored, the basal collar absent or very minute, the tip of the sporangiophore slightly convex and marked with a shining spot; spores elliptical 7-9 × 4-5μsmooth, colourless; conidia globose, echinulate, on short non-septate stalks.

On rabbit dung, Whitby, September, 1904.

The specimen grew on some pellets of rabbit dung, kept in a moist atmosphere for a week or two. The stalks were markedly

septate, firm, and upright, but I did not find the swollen basal hyphae. The spores were also distinctly smaller, $6 \times 3\mu$ or even somewhat less. It seems preferable to record it under the above species as *Var. parvispora* A.L.Sm.

Melanospora lagenaria Fckl. Sym., p. 126.

Perithecia scattered or gregarious, globose or somewhat ovate, slightly wrinkled, sparingly hirsute, furnished at the base with numerous yellowish hyphae, soft, at first yellowish brown becoming blackish, about $\frac{1}{2}$ mm. in diameter, the beak $2\frac{1}{2}$ mm. in length, rather bent, fringed at the top with white hairs; asci broadly clavate, stalked 35-40 × 12-15μ, 8 spored; spores elliptical, pointed at the ends, brown, 11-14 × 6μ.

On decaying *Polyporus*, etc.

Found by W. Williams on decaying fungus (Stereum?) in Bushey Park, Middlesex, November, 1904.

Calonectria vermispora Mass, and Crossl. Naturalist, January, 1904, p. 4.

On a decorticated fallen trunk, Hardcastle (Coll. J. Needham, November, 1897).

Venturia Thwaitesii Mass. and Crossl. Naturalist, January, 1904, p. 3.

On dead stems of wild Raspberry.

Dilophospora albida Mass. and Crossl. Naturalist, January, 1904, p. 3.

On dead stems of Epilobium hirsutum, Lee Mill Road, Hebden Bridge (Coll. J. Needham, August, 1890).

Gnomonia Needhami Mass. and Crossl. Naturalist, January, 1904, p. 3.

On dead fir leaves, Crimsworth Dean, Hebden Bridge (Coll. J. Needham, May, 1897).

Stictis sulfurea Rehm, Rabenhorst's Krypt. Flora, Bd. 1, Abth. 3, p. 177.

Apothecia gregarious, at first closed, globose, immersed then bursting the bark and opening finally with a margin of 4-5 reddish yellow lobes; the disc white, furfuraceous, then sulphur yellow $\frac{1}{2}$ to $1\frac{1}{2}$ mm. broad; asci cylindrical, thickened at the apex 100-120 × 8-9μ,8 spored; spores elongate, pointed, mostly

straight, multiseptate, 75-80 × 4-4·5 μ; paraphyses thread-like, straight, colourless.

On a decaying oak-branch.

Coll. by W. Williams on a bit of bark, Bushey Park, Middlesex, November, 1904.

Coryne aquatica Mass. and Crossl. Naturalist, January, 1904, p. 6.

Gregarious, among moss on a boulder in a stream. Egton Bridge, Y.N.U. Foray, September, 1902 (Coll. G. Massee).

Sphaerospora citrina Mass. and Crossl. Naturalist, January, 1904, p. 4.

On peaty ground, Redcar. (Coll. E. M. Holmes, September, 1901).

Dasyscypha lactior (Karst.,) Sacc., Syll. Fung., viii., p. 441.

On dead wild Raspberry canes, Midgehole, Hebden Bridge, May, 1899 (Coll. J. Needham). Masham, July, 1902 (Coll. W. A. Thwaites). Naturalist, January, 1904, p. 5.

Peziza recedens Boud. Bull. Soc. Myc., France, 1898, p. 18, tab. v., fig. 1.

On the cortex side of a tub-garth, partly lying in a stagnant pool, Halifax. (Coll. C. Crossland, July, 1892). Naturalist, January, 1904, p. 4.

Durella melanochlora Rehm., Ascom. Alp. No. 27.

On decorticated Alder. Heptonstall (Coll. Crossland and Needham, June, 1899), Naturalist, January, 1904, p. 6.

Phoma caulographa Dur. and Mont., Mont. Syll. No. 978.

On dead stems of *Chaerophyllum temulentum*. Canal bank, near Elland (Coll. H. T. Soppitt, January, 1898). Naturalist, January, 1904, p. 6.

Symphosira parasitica Mass and Crossl. Naturalist, January, 1904, p. 6.

Parasitic on the fallen mericarps of *Conium maculatum*. Sutton, near Askern (Coll. A. Clarke and C. Crossland at the Sutton Y.N.U Foray, September, 1899.

Tricholoma horribile Rea, see Pl. 7.*

Pileus, fleshy, 10-12 cm. broad, convex, then expanded, densely covered with dark fuscous squamules, which become

*This plate has been kindly given by the Rev. W. L. W. Eyre as a donation to the printing Fund.

E. A. Rea del.

West, Newman chromo London

Tricholoma horribile *Rea.*

squarrose with age, especially at the centre, and the whole pileus becomes tinged *with a pink background at maturity*, margin thin exceeding the gills. Stem 8-9 cm. long, by 2 cm. thick, incrassated at the base, white, hollow, smooth. Flesh thin, white *becoming pinkish, everywhere covered with fuscous spots*, which on the interior of the pileus suggest as if the squamules had been rivetted through the depth of the flesh. Gills emarginate 2 cm. wide, crowded, margin uneven, whitish, *becoming pinkish with age*. Spores white, globose × 5 μ. Easily distinguished from its allies by the plant everywhere (with the exception of the exterior of the stem), turning pinkish with age and by the fuscous spots in the interior of the stem and pileus.

Under Beech trees, Swarraton, Hants., 31st October, and 2nd November, 1903, Revd. W. L. W. Eyre.

Entoloma Farrahi Mass. and Crossl. Naturalist, January, 1904, p. 1, pl. 1, figs. 1-4.

Among short grass on "The Terrace overlooking Rievaulx Abbey, Helmsley." (Coll J. Farrah, F.L.S., at the Y.N.U. Fungus Foray, 1903). "Differs from all allies in the smooth elliptical spores."

Nolanea papillata Bres. t. 82, f. 1, N. mammosa var. minor, Fr. Ic., t. 98, f. 4. Batsch f, 5, Cke. Illus. t. 377, f. 2.

Pileus 2-3 cm. wide, submembranaceous, subcampanulate, convex, then expanded, *papillate*, striate, fuscous-bay, somewhat cinnamon colour when dry. Stem 4-5cm. long, by about 2mm. thick, fistulose, glabrous, *shining*, obsoletely white-mealy at the apex, white tomentose at the base. Flesh concolourous. Gills 3-5 mm. wide, somewhat crowded, livid white, becoming fuscous flesh colour, sinuato-adnate. Smell pleasant, but often very faint and sometimes absent. Spores 5-7 angled 8-11 × 6-7μ. Iburndale, Yorkshire, 15th September, 1904.

Inocybe lanuginosa (Karst.) Mass, Massee Monograph of the genus Inocybe, Annals of Botany, 1904, p. 468 and 469.

"The spores are irregularly oblong, apiculate, with somewhat acute warts, 9-12 × 8μ. In Brit. Fungus Flora, II., p. 183, the spores are incorrectly said to be smooth."

Inocybe calospora Quél. in Bres. Fung. Trid., I., p. 19, t. 21; Sacc., Syll. v. p. 773; I. rigidipes Peck., 51 Rep. State Mus., p. 289 (1897), l.c., p. 469.

Pileus convex or campanulate, then expanded and umbonate, fibrillose with darker squamules at the disc, yellowish brown or

tawny grey, edge paler, 1·5-2·5 cm. Gills sinuate, almost free, tawny-ochre or brownish. Stem slender, pale, then reddish or coloured like the pileus, 4-5cm. Spores globose, with numerous rather long, slender, cylindrical papillae, 10-12μ. Cystidia not numerous, subcylindrical or slightly fusiform 45-55 × 11-14μ. On the ground in woods and shady places. Britain (Wothorpe).

Inocybe Bucknalli Mass. l.c., p. 473.

Pileus campanulato-convex, fibrillose, with a few squamules near the disc, brownish, 1-2cm. Gills adnexed, thick, rather distant, rusty-brown, edge minutely fimbriate. Stem equal or slightly thickened at the base, slender, fibrillose, brownish, 2-4 cm. Spores irregularly oblong, one end obliquely apiculate, rather coarsely nodulose, 15-17 × 8-9 μ. Cystidia absent. *Basidia* clavate, *exceptionally large*, 70-80 × 16-18μ, 4-spored. On the ground under bushes. Britain (Leigh Down, Bristol. Cedric Bucknall).

Inocybe cervicolor Quel., Fl. Myc., p. 107; *Ag. cervicolor* Pers., Icon. Pict. Rar. Fung. t. 8, f. 4 (1803-1806), Mass, l.c., p. 479.

Pileus campanulate, pale brown or fawn-colour, covered with brown, recurved fibrils, 3-5 cm. Gills emarginate, ventricose, distant, pale then rusty brown, margin whitish, denticulate. Stem elongated, firm, whitish, fibrillose, with brown recurved filaments throughout its length, 6-9 cm. Spores elongate, pip-shaped, smooth, 11-13 × 6-6·5. Cystidia cylindric-fusoid, numerous, 40-50 × 12-18μ. Flesh white, tinged purplish when cut. Smell strong, unpleasant. Among grass in woods. Britain.

Inocybe Godeyi Gillet, Champ. Fr., Hym., p. 517 (1874); Sacc., Syll. v. p. 778; *Ag.* (*Ino.*) *Trinii* Pat., Tab., Anal., n.345; and *Ag.* (*Ino.*) *Trinii* var. rubescens, n. 344; *I. rubescens* Gill., Rev. Myc., v., p. 31 (1883); and Champ. Fr. Hym. with plate, and described in the general index (1897); Sacc., Syll. v., p. 786; *Ino. Trinii* Bres. (non Weinm), Fung. Trid., II., p. 14, t. 120; *Ino. repanda* Quél (non Bull.), Flor. Myc., p. 101 (1888); *Ino. hiulca* Kalch., p. 33, t. 20, f. 2; Sacc. Syll. v., p. 774. Mass. l. c. p. 481, and see pl. 8 hereof.

Pileus campanulate, obtusely umbonate, silky-fibrillose, rimose, whitish at first, then more or less suffused with a rosy tinge, which is usually accompanied by an ochraceous tinge, margin splitting, 3-5 cm. Gills narrowed behind and adnexed, almost free, somewhat crowded, whitish then dusky cinnamon, usually with an olive tinge, edge white, minutely flocculose. Stem equal, slightly bulbous, colour of the pileus, apex white-pruinose,

Inocybe Godeyi *(Gillet) Mass.*

Inocybe fulvella *Bres.*

E. A. Rees del. West, Newman chromo. London

4-6 cm. Spores elliptical, slightly curved or subreniform, smooth, 9-12 × 5·5-6 μ. Cystidia ventricose, 40-65 × 15-20 μ, fairly numerous. Smell strong, unpleasant.

On the ground in woods, &c., Britain.

One of the larger species of Inocybe characterized by the pileus and stem being either pure white, or nearly so, and silky when young. As the fungus advances in age rosy-red or ochraceous-rosy stains appear on the pileus and stem. These tints are also produced when the plant is bruised.

Inocybe mimica Mass. l.c., p. 492.

Pileus campanulate, obtusely umbonate, fibrillose yellow-brown, everywhere covered with large, adpressed, slightly darker fibrous scales, 6-8 cm. Gills broad, deeply sinuate and attached to the stem by a very narrow portion, yellow-brown. Stem solid, equal, fibrillose, paler than the pileus, 6-8 cm. long, 1 cm. thick. Spores subcylindrical with an oblique apiculus, smooth, 14-16 × 6-8 μ. Cystidia absent.

On the ground in woods. Britain (Castle Howard, Yorks., September, 1892). The pileus exactly mimics that of Lepiota Friesii, as figured in Cooke's Ill., p. 941, hence the specific name.

Inocybe fastigiata (Karst.) Mass., l.c., p. 495.

"The spores are elliptical, sometimes slightly curved, smooth, 8-11 × 6-7μ Cystidia absent." "In Brit. Fung. Flora II., p. 192, not having an authentic specimen, I copied Saccardo's account of spores and cystidia."

Agaricus plumosus Bolt., Mass. l.c., p. 500., Bolt. pl. 33 (1788).

Massee is "inclined to think that the fungus Bolton had in view was a species of *Collybia* of the section Vestipedes."

Inocybe violaceafusca Cke. and Mass., l.c., p. 501.

This proves to be a *Cortinarius* and will thus become C. (Dermo.) violaceo-fuscus Cke. and Mass.

Inocybe tricholoma A. and S., Mass., l.c., p. 501.

"This has been correctly referred to Flammula by Karsten,* on the label to Kart. Fung. Fenn., exs. 412."

Inocybe phaeocephala (Bull.,) Fr. Mass., l.c., p. 501., Cke., Ill., pl. 396.

Massee finds "no justification for the retention of this species

*Fries placed it in Flammula in his Monographia, Vol. I., p 350.

in *Inocybe*. It was first placed there by Fries, who never saw what he considered to be that species, but drew up his diagnosis from Bulliard's figure, adding a rider to the effect that its position is doubtful. Cooke's description with a 'smooth pileus' and 'bright ferruginous spores' certainly does not suggest *Inocybe*."

Inocybe schista Cke. and Sm. Mass., l.c., p. 501., Cke., Ill., pl. 504.

"A species founded entirely on a sketch, which may or may not have been accurately done in the first instance."

Coprinus aquatilis Peck.

Among decaying leaves of *Luzula sylvatica*, moss, twigs, etc., in swamp, High Lee Clough, Norland, Halifax, June, 1900. Naturalist, January, 1904, p. 2.

Marasmius lagopinus Post., in Fr. Hym. Eur., p. 474.

Duncombe Park, Helmsley, Y.N.U. Fungus Foray, October, 1903. (Coll. Messrs. Needham and Thwaites). Naturalist, January, 1904, p. 2, pl. 1, figs, 8-10.

Clavaria tenerrima Mass. and Crossl. Naturalist, January, 1904, p. 2.

Among short grass, Halifax. (Coll. C. Crossland).

Pistillaria pusilla Fr. Syst. Myc., 1, p. 498, Hym. Eur. p. 688. Reinke in Berthold, Zersetz. d. Kartoffel, 1879, pl. vi., figs. 12-4.

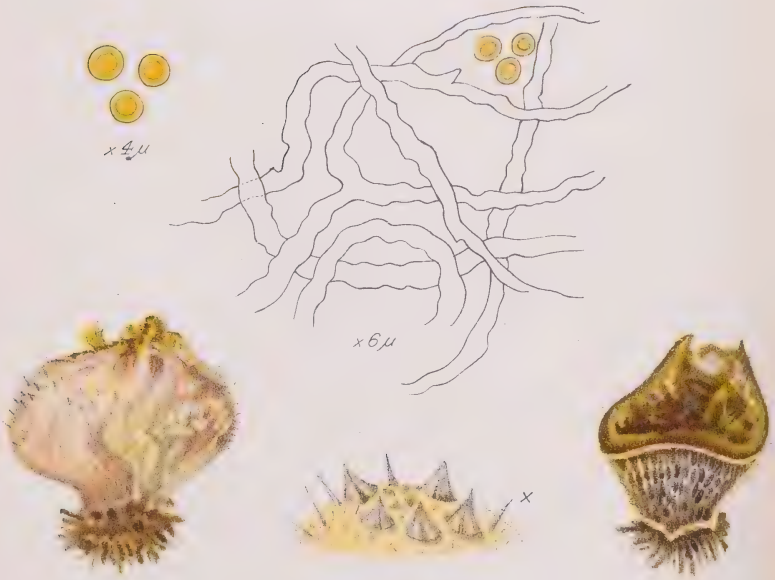
Small, linear, tapering, white up to $\frac{1}{2}$ or 1 cm. in height, stalk scarcely distinct; basidia 2-spored; spores $10 \times 4\mu$., colourless.

On dead leaves from Southampton, February, 1904.

Lycoperdon depressum Bon. Bot. Zeit. 1857, p. 611, and see pl. 9 hereof.

Peridium $2\frac{1}{2}$-3 cm. high by 3-5 cm. wide, obconic, at first rounded at the two ends, then becoming flattened on the top, often compressed at the sides, more or less contracted at the base and plicate; yellowish white, then greyish yellow and finally brownish; covered with spinulose warts which are united at the apex, intermixed with minute simple spines and furfuraceous granules, all of which wear away with age; dehiscing by a well defined apical aperture which soon extends until the whole of the upper portion of the peridium disappears. Sterile base well developed, cellular and *separated from the fertile portion by a well defined diaphragm;* Capillitium copious, threads branched, *colourless*, flexuose, rough, up to 6μ wide; Spores globose, smooth, olivaceous $\times 4\mu$.

Inocybe brunnea *Quél.*



Lycoperdon depressum *Bon.*

Easily distinguished amongst the smaller Lycoperda by the presence of a well developed diaphragm between the sterile and the fertile tissue, and the colourless capillitium, it resembles L. caelatum in having a diaphragm, but it is constantly smaller, and the armature of the exoperidium is very different.

Amongst short grass, Kempsey Common, Worcestershire, 22nd August, 1903; Tickwood, Salop, 6th September 1904; New Forest, 25th October, 1904, and Lyme Regis, Dorset, C. Rea. Probably common, but hitherto overlooked.

MYCETOZOA.

Badhamia populina A. and G. List. Journ. Bot. xlii., (1904), p. 129, pl. 459, fig. 1.

On bark of old prostrate stem of Populus, Epping Forest. (Coll. T. Petch, November, 1902).

B. foliicola List. Tom. cit., xxxv. (1897), p. 209.

On brushwood, etc., Chigwell Lane and Leytonstone, Essex, and also collected in East Yorkshire by T. Petch. Tom. cit. xlii., p, 129.

B. decipiens Berk.

On wood, moss, etc., Tansterne, Yorks. Coll. T. Petch, August, 1903, Tom. cit. p. 130.

B. rubiginosa Rost. var. *globosa* A. and G. List. Tom. cit. p. 130.

On mosses, Llan-y-Mawddwy, N. Wales. Also a specimen in Wilson's Herbarium from Clough, Cheshire, November, 1854.

Trichia lutescens List. Sym. Oligonema furcatum Bucknall.

On a rotten plank, North Cave, East Yorkshire, T. Petch. Abbots Leigh, C. Bucknall. Tom. cit. p. 136.

Oligonema flavidum Peck.

On mossy Alder log, Horsham, Sussex, August, 1902. Miss A. Hibbert-Ware. Tom. cit., p. 137.

Perichaena variablis var. *pedata* A. and G. List.

On dead leaves, Lyme Regis, April, 1902. Tom. cit., p. 139.

OFFICERS FOR THE SEASON 1904.

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Published 13th May, 1905.

THE HASLEMERE FORAY.

25th to 30th September, 1905.

The ninth annual week's Fungus Foray was held at Haslemere by invitation of the Haslemere and Hindhead Microscope and Natural History Society and Professor Jonathan Hutchinson, LL.D., F.R.S., D. Sc., F.R.C.S., most kindly placed his Educational Museum at the disposal of the Society for its use as the headquarters during the meeting. On the afternoon of Monday, the 25th of September, Dr. Jonathan Hutchinson received the members on their arrival at the headquarters and courteously conducted them over his very interesting museum and later in the evening, the following specimens were placed out on exhibition by Mr. W. B. Allen from the neighbourhood of Benthall, Salop. *Lepiota lenticularis* (Lasch.), *Inocybe obscura* (Pers.), *Inocybe rhodiola* (Bres.) Mass. (New to the British Fungus Flora), *Lactarius insulsus* Fr., *Lactarius helvus* Fr., *Boletus candicans* Fr., *Boletus felleus* Bull., the rare *Hydnotrya Tulasnei* B. & Br.† and *Rhizina undulata* Fr., by Mr. E. W. Swanton from the vicinity of Haslemere *Trametes Bulliardi* Fr., *Tremellodon gelatinosum* Pers. *Polystictus Montagnei* (Fr.) (first record for Britain gathered near Grayswood in 1898) and *Boletus parasiticus* Bull. on *Scleroderma vulgare* Fr. (collected by Mr. Chuter near Shottermill), by Mr. J. F. Rayner from the New Forest *Pleurotus acerinus* Fr. and *Stereum multizonatum* B. & Br. and from Bere *Russula chloroides* (Krombh.) Bres. and *Lycoperdon umbrinum* Pers., by the Hon. Secretary the first two British specimens of *Pleurotus decorus* Fr. which he had received from their fellow member, Mr. Angus Grant, gathered in the neighbourhood of Drumnadrochit and *Stropharia squamulosa* Mass.*

On Tuesday, the 26th of September, the members assembled at the Town Hall at 10 o'clock from whence they were driven in carriages‡ to Woolmer Forest, a distance of about seven miles. Here the woods and open heath lands were very carefully investigated, and on an examination of the bag at the end of the day, it was found to include *Collybia extuberans* (Batt.) Fr., *Cortinarius* (*Inoloma*) *bolaris* (Pers.) Fr., (*Dermocybe*) *orellanus*

† For an illustration of this rare species, see plate 11 hereof.

* For description see Trans. Brit. Myc. Society Vol. I. p. 23.

‡ The carriages were kindly provided by the Haslemere Natural History Society.

Fr., (*Hygrocybe*) *rigens* Fr.; *Polyporus Schweinitzii* Fr.; *Hydnum imbricatum* L.; *Sparassis crispa* (Wulf.) Fr., *S. laminosa* Fr. (first record for Britain) and *Claviceps microcephala* (Wallr.) which infested the grass *Molinia caerulea*. The return drive to Haslemere was commenced about 5 o'clock. In the evening, at 8.30 at the headquarters, the President (Mr. R. H. Biffen, M.A.,) presided over the annual election of officers for the ensuing year, Mr. Arthur Lister, F.R.S. was unanimously elected President; Professor H. Marshall Ward, D.Sc., F.R.S., &c., Vice-President, and Mr. Carleton Rea, B.C.L., M.A., Hon. Secretary and Treasurer. The Hon. Secretary read two invitations, one from Professor M. C. Potter, suggesting a meeting at Newcastle-upon-Tyne, where the Durham College of Science would place rooms at the disposal of the Society during the foray, and also the Natural History Society would throw open the museum and give the use of the Library and Committee rooms if required. The Duke of Northumberland and Lord Barrow would give permission to visit the park at Alnwick and at Raby (each about 30 miles from Newcastle) whilst Gilside and other woods were about 10 miles distant. The other invitation was from the Rev. H. Purefoy Fitz-Gerald, F.L.S., of Wellington College, Berkshire, urging the Society to visit that part of the country one year and that he would do all that he could to make the necessary arrangements. These invitations were carefully considered, but it was decided that as Mr. Arthur Lister had so very kindly consented to accept the position of President, that Epping Forest must be the scene of their Foray for 1906, the headquarters and date to be subsequently fixed by the President and Hon. Secretary after consultation with the Secretary of the Essex Field Club. The Newcastle invitation would very probably be acceptable for 1907 as a northern meeting would be desirable for that year and then probably the Rev. H. Purefoy's invitation to Wellington would be favourably considered for 1908, but the further consideration of these invitations must be deferred until next year. The Hon. Treasurer reported that the sum of £25. 12s. 8d. stood to their credit at the Post Office but that that amount included one subscription for 1906 and a payment of £1. 17s. 6d. by the United States Department of Agriculture in advance for the whole of Volume ii. of their Transactions.

On Wednesday, September 27th, the members were busy in determining the finds of the previous day up till 11 o'clock, at which hour they departed in brakes* through lovely scenery to Hindhead, where they descended at a place called the Land of Nod. Mrs. Arnold Lyndon met the members here and kindly acted as guide through Mr. A. T. Whitaker's woods in the neigh-

* The brakes were kindly provided by the Haslemere Natural History Society.

bourhood of Grayshott, but some of the older members could not keep up with the pace set by Mrs. Lyndon and so probably covered quite distinct ground from that traversed under her leadership. They however secured some examples of *Clitocybe hirneola* Fr., *Collybia atrata* Fr., *Inocybe eutheles* B. & Br., *Boletus castaneus* Bull., and *Hydnum nigrum* Fr. The two divisions reunited at the Fox and Pelican at Hindhead at 5 p.m. and the carriages were then re-entered for the return drive to Haslemere, during the course of which it was ascertained that the forward division had collected nice specimens of *Cortinarius (Inoloma) violaceus* (L.), *Clavaria argillacea* Pers., *Hydnum zonatum* Batsch, *Ulocolla foliacea* Bref. and *Otidea leporina* (Batsch) Fckl. In the evening the annual club dinner was held at the White Horse Hotel, and subsequently the President (Mr. R. H. Biffen, M.A.) at the headquarters delivered his Presidential Address entitled "Combating the Fungoid Diseases of Plants" (see p. 112), after which the Hon. Secretary brought to the notice of the members two recent additions to the British list, viz., *Polyporus benzoinus* Fr. and *Marasmius archyropus* Fr. var. *suaveolens* Rea., both of which are dealt with in the Fungi New to Britain (see p. 127). Mr. Rea also exhibited a specimen of *P. benzoinus* Fr. and of the somewhat rare *Choiromyces meandriformis* Vitt. which he had received from their member Mr. W. B. Allen from Benthall earlier in the season and he also handed round a drawing by Mrs. Rea of *Lactarius spinosulus* Quél, which from the books seemed as regards the type to have been hitherto unrecorded for Britain, and Mr. W. B. Allen, with the same end in view, brought a specimen in spirit for their examination. Mr. A. D. Cotton, F.L.S., exhibited some potatoes infested with *Œdomyces leproides* Trabut.

On Thursday, Sept. 28th, the morning was devoted to the examination of the material collected on the previous days and after the members had been photographed, a late start was made about 12.30, under the leadership of Mr. E. W. Swanton. They first proceeded up the High Street and took the right hand road, and after a short time traversed a pasture on the other side of which they entered a wood that had been very recently cut down and which was now overgrown with brambles. Mr. Woodcock, who had very kindly offered to conduct the members, next led them into a very swampy wood belonging to Mrs. Stewart Hodgson, where but very little of interest was to be found. The members next explored the wood on Grayswood Common, where on two separate occasions examples have been found of the rare Phalloid *Clathrus cancellatus* Tournef. A very careful and prolonged search was made here but the wood was too thick and overgrown, and although the members tried to detect the *Clathrus* by its vile odour nothing better than

Ithyphallus impudicus Fisch. and *Mutinus caninus* Fr. rewarded their endeavours with the exception that Mr. J. F. Rayner secured a nice tuft of *Clitocybe pergamena* Cke. The walk was then continued uphill and down dale till the members neared the confines of Dr. Jonathan Hutchinson's house, where they collected some examples of *Hygrophorus foetens* Phill. (it is questionable whether this be really distinct from Eccilia atropuncta Pers., which is said to have a very strong unpleasant smell when past perfection), *Geoglossum glabrum* Pers. and *Rhopographus Pteridis* (Sow.) Wint. Some of the members proceeded direct from Haslemere to Dr. Jonathan Hutchinson's house, where they were all hospitably entertained to tea. The return walk was taken across the fields and Miss Eyre boxed some specimens of *Leptonia solstitialis* Fr.

In the evening Dr. C. B. Plowright gave a popular lecture on "Mushrooms and Toadstools" to the members of the Haslemere and Hindhead Microscope and Natural History Society, which was much appreciated, and Mr. J. F. Rayner followed with a paper entitled "Mycology as a Branch of Nature Study" (see p. 123). Hearty votes of thanks were then accorded to the Haslemere and Hindhead Miscroscope and Natural History Society for the very kind way that they had received the Society; to Dr. Jonathan Hutchinson for placing his very interesting Educational Museum at their disposal for the exhibition of the fungi collected, the reading of papers and the transaction of the Society's business; to the various landowners and tenants for the kind permissions to go over their woods and lands; and to their fellow member, Mr. E. W. Swanton, for all the trouble and care that he had taken in making all the arrangements for the very successful week's foray at Haslemere. Monsieur Emile Boudier was then unanimously elected the first Honorary Member of the Society under Rule 4, which provides that gentlemen of pre-eminence in Mycology or who have rendered special service to the Society are alone eligible for this position. Both these qualifications Monsieur Boudier possessed and they were grateful to him for his assistance in the past. Subsequently the Hon. Secretary communicated this resolution to Monsieur Boudier, and in reply received the following gracious letter:—

"J'ai bien reçu hier la lettre par laquelle vous m'annonciez que la Société Mycologique d'Angleterre venait de m'accorder le titre de Membre honoraire. C'est un honneur auquel j'ai été d'autant plus sensible que je ne m'y attendais pas. Je viens donc vous prier, cher Monsieur, d'être mon interpréte auprès des membres de la Société pour les remercier de l'insigne honneur qu'ils me font en m'accordant ce titre réservé, je le sais, à des Mycologues qui ont bien mérité de la Science. J'ai toujours eu de trop bons rapports avec nos collègues, en Mycologie d'Angleterre que j'ai

pu apprecier, pour ne pas être fier de ce titre et je suis heureux de pouvoir me regarder comme un de leurs membres. Veuillez agréer, Monsieur le Secrétaire général et bien cher Collègue avec mes remerciments, l'assurance de mes meilleurs sentiments et veuillez me croire toujours, votre bien dévoué. Boudier, Montmorency, ce 30 Octobre, 1905."

On Friday, the 29th of September, the morning was spent in the determination of the specimens, and Mr. E. M. Holmes kindly brought to the headquarters a very interesting stag's horn form of *Polyporus squamosus* (Huds.) Fr. which was found in a London cellar. About 1 p.m. Mr. E. W. Swanton led the members off to Marley Heights. On Marley Common *Clavaria argillacea* Pers. was gathered and *Otidea aurantia* (Pers.) Mass. was remarkably abundant on the new road leading up to the top of the promontory. Upon ariving at the farm house the members were hospitably entertained to tea by Mr. Herbert Hutchinson and shortly afterwards the return walk was commenced to Haslemere. The most interesting specimens collected during the day included *Cortinarius (Phegmacium) triumphans* Fr., *cristallinus* Fr., *(Telamonia) armillatus* Fr., and *Craterellus crispus* Fr.

On Saturday, the 30th of September, Mr. D. Taylor brought in a fine example of *Clavaria formosa* Pers. and *Helvella lacunosa* Afz. which he had collected near Fernhurst. Four hundred and eighty-eight species were identified during the foray, and Miss A. Lorrain Smith, F.L.S., subsequently reported that she had found *Hypoderma Desmazieri* in Woolmer Forest, which is a recent addition made by her to the British list, and a full description of the same is set out on p. 128.

COMPLETE LIST OF FUNGI GATHERED DURING THE FORAY.

Amanita phalloides Fr., mappa (Batsch) Fr., muscaria (Linn) Fr., pantherina (DC.) Fr., rubescens Pers., spissa Fr.
Amanitopsis vaginata (Bull.) Roze, strangulata (Fr.) Mass.
Lepiota procera (Scop.) Fr., rachodes (Vitt.) Fr., gracilenta (Kromb.) Fr., cristata (A. & S.) Fr., amianthina (Scop.) Fr.
Armillaria mellea (Vahl.) Fr., mucida (Schrad.) Fr.
Tricholoma resplendens Fr., flavo-brunneum Fr., albobrunneum (Pers.), rutilans (Schaeff.), columbetta Fr., terreum (Schaeff), saponaceum Fr., sulphureum (Bull), carneum (Bull.), personatum Fr., nudum (Bull.), panaeolum Fr., grammopodium (Bull.).
Clitocybe nebularis (Batsch), hirneola Fr., odora (Bull.), rivulosa Pers., cerussata Fr., phyllophila Fr., pergamena Cke., infundibuliformis (Schaeff.), inversa (Scop.), flaccida (Sow.), cyathiformis Fr., metachroa Fr., ditopa Fr., fragrans (Sow.).
Laccaria laccata (Scop.), Berk, var. amethystina Bolt. var tortilis Bolt.
Collybia radicata (Rehl.), fusipes (Bull.), maculata (A. & S.), butyracea (Bull.), velutipes (Curt.), conigena (Pers.), tuberosa (Bull.), acervata Fr., dryophila (Bull.) extuberans (Batt.) Fr., atrata Fr.
Mycena pura Pers., luteo-alba (Bolton), lactea Pers., rugosa Fr., galericulata (Scop.), var. calopa Fr., polygramma (Bull.), alcalina Fr., metata Fr., sanguinolenta (A. & S.), galopa Fr., leucogala Cke., epipterygia (Scop.), clavicularis Fr., pelliculosa Fr., vulgaris Pers., tenerrima (Berk.), capillaris (Schum.).
Omphalia rustica Fr., fibula (Bull.), var. Swartzii Fr.
Pleurotus septicus Fr.
Pluteus cervinus (Schaeff.).
Entoloma lividum Fr., sinuatum Fr., porphyrophaeum Fr., jubatum Fr., sericellum Fr., rhodopolium Fr., sericeum (Bull.), nidorosum Fr.
Clitopilus prunulus (Scop.).
Leptonia lampropa Fr., solstitialis Fr.
Nolanea pascua (Pers.), pisciodora (Ces.).
Claudopus variabilis (Pers.).

Pholiota terrigena Fr., erebia Fr., togularis (Bull.), radicosa (Bull.), spectabilis Fr., mutabilis (Schaeff.), marginata (Batsch).

Inocybe pyriodora (Pers.), maritima Fr., rimosa (Bull.), asterospora Quél, eutheles (B. & Br.), geophylla (Sow.), petiginosa (Fr.) Quél.

Hebeloma fastibile Fr., versipelle Fr., mesophaeum Fr., crustuliniforme (Bull.), nauseosum Cke.

Flammula carbonaria Fr., flavida (Schaeff.), inopa Fr., sapinea Fr.

Naucoria escharoides Fr.

Galera tenera (Schaeff.), spartea Fr., hypnorum (Batsch).

Tubaria furfuracea (Pers.), crobula Fr.

Crepidotus mollis (Schaeff.).

Agaricus arvensis Schaeff. xanthodermus Gen., campestris Linn., comtulus Fr.

Stropharia aeruginosa (Curt.), inuncta Fr., stercoraria Fr., semiglobata (Batsch), squamosa Fr.

Hypholoma sublateritium (Schaeff.), epixanthum Fr., fasciculare (Huds.), dispersum Fr., lacrymabundum Fr., velutinum Pers., appendiculatum (Bull.), hydrophilum (Bull.).

Psilocybe subericaea Fr., uda (Pers.), semilanceata Fr., foenisecii (Pers.).

Psathyra corrugis (Pers.), fibrillosa (Pers.).

Anellaria separata (Linn.).

Panaeolus sphinctrinus Fr., campanulatus (Linn.), papilionaceus (Bull.).

Psathyrella gracilis Fr., disseminata (Pers.), atomata Fr.

Coprinus comatus Fr., atramentarius Fr., niveus Fr., micaceus (Bull.), lagopus Fr., domesticus Pers., plicatilis (Curt.).

Bolbitius fragilis Fr.

Cortinarius (Phlegmacium) triumphans Fr., largus Fr., multiformis Fr., purpurascens Fr., crystallinus Fr.

(Myxacium) collinitus Fr., var. mucosus Fr., elatior Fr.

(Inoloma) violaceus (Linn.), albo-violaceus (Pers.), bolaris (Pers.), pholideus Fr.

(Dermocybe) tabularis Fr., caninus Fr., anomalus Fr., lepidopus Cke., sanguineus Fr., cinnamomeus Fr., var. semisanguineus Fr., orellanus Fr.

(Telamonia) torvus Fr., armillatus Fr., hinnuleus Fr., brunneus (Pers.), hemitrichus Fr., paleaceus Fr.

(Hydrocybe) subferrugineus Fr., duracinus Fr., castaneus (Bull.), dolabratus Fr., rigens (Pers.), decipiens (Pers.), acutus (Pers.).

Gomphidius glutinosus (Schaeff.), roseus Fr., viscidus (Linn.), gracilis Berk.

Paxillus involutus (Batsch), panuoides Fr.

Hygrophorus cossus (Sow.), pratensis (Pers.), virgineus (Wulf.), niveus (Scop.), foetens Phill., laetus Fr., coccineus (Schaeff.), miniatus Fr., turundus Fr., puniceus Fr., conicus (Scop.), chlorophanus Fr., psittacinus (Schaeff.), unguinosus Fr.

Lactarius torminosus (Schaeff.), turpis (Weinm.), pubescens Fr., insulsus Fr., blennius Fr., pyrogalus (Bull.), chrysorrheus Fr., piperatus (Scop.), vellereus Fr., deliciosus (Linn), quietus Fr., theiogalus (Bull.), vietus Fr., rufus Scop., glyciosmus Fr., serifluus (DC.), mitissimus Fr., subdulcis (Bull.).

Russula nigricans (Bull.) Fr., adusta Pers., densifolia Secr., chloroides (Krombh) Bres., furcata Pers., drimeia Cke., lactea Fr., var. incarnata Quél., virescens (Schaeff.), lepida Fr., xerampelina Fr., vesca Fr., cyanoxantha (Schaeff.), heterophylla Fr., foetens Pers., fellea Fr., emetica Fr., ochroleuca Fr., fragilis Pers., var. violacea Quél.

Cantharellus cibarius Fr., aurantiacus Fr., tubaeformis Fr., infundibuliformis Fr.

Nyctalis asterophora Fr., parasitica (Bull.).

Marasmius peronatus (Bolt.), oreades (Bolt.), erythropus Fr., ramealis (Bull.), rotula (Scop.), androsaceus (Linn.), epiphyllus Fr.

Lentinus cochleatus Fr.

Panus stipticus (Bull.).

Lenzites betulina (Linn.).

Boletus luteus Linn., elegans (Schum.), flavus With., chrysenteron Fr., subtomentosus Linn., radicans Pers., pruinatus Fr., variegatus Swartz., badius Linn., piperatus Bull., bovinus Linn., granulatus Linn., edulis Bull., luridus Schaeff., laricinus Berk., scaber Fr., versipellis Fr., castaneus Pers.

Fistulina hepatica Fr.

Polyporus Schweinitzii Fr., rufescens Fr., squamosus (Huds.) Fr., intybaceus Fr., sulphureus Fr., betulinus (Bull.) Fr., adustus Fr., amorphus Fr., lacteus Fr., fragilis Fr.

Polystictus versicolor (Huds.), radiatus (Sow.), abietinus Fr.

Fomes igniarius (Huds.), annosus Fr., ferruginosus (Fr.) Mass.

Poria vaporaria Fr.

Daedalea quercina (Linn.).

Merulius lacrymans Fr.

Hydnum imbricatum Linn., repandum Linn., zonatum Batsch., nigrum Fr., auriscalpium Linn., niveum Pers., farinaceum Pers.

Irpex obliquus (Schrad.).
Phlebia merismoides Fr., radiata Fr.
Grandinia granulosa Fr.
Craterellus cornucopioides Pers., crispus Fr.
Stereum hirsutum Fr., purpureum Pers., rugosum Fr., spadiceum Fr.
Corticium calceum Fr., laeve Pers., nudum Fr., comedens Fr.
Hymenochaete rubiginosa Lév.
Peniophora quercina (Fr.) Cke., incarnata (Fr.) Cke.
Thelephora anthocephala Fr., laciniata Pers.
Coniophora puteana (Fr.) Mass.
Soppittiella sebacea (Berk.) Mass.
Sparassis crispa (Wulf.) Fr., laminosa Fr.
Clavaria muscoides Linn., cinerea Bull., cristata Holmsk., rugosa Bull., formosa Pers., abietina Schum., fusiformis Sow., dissipabilis Britz., inaequalis Fl. Dan., argillacea Pers., vermicularis Scop., fragilis Holmsk., tenuipes B. & Br.
Typhula erythropus Fr.
Pistillaria quisquiliaris Fr.
Auricularia mesenterica Fr.
Exidia albida (Huds.) Bref.
Ulocolla foliacea (Pers.) Bref.
Tremella mesenterica Retz., intumescens Eng. Bot.
Dacryomyces deliquescens Duby.
Calocera viscosa Fr., stricta Fr.
Cyathus striatus Hoffm.
Crucibulum vulgare Tul.
Sphaerobolus stellatus Tode.
Lycoperdon excipuliforme Scop., gemmatum Batsch., pyriforme Schaeff., perlatum Pers., umbrinum Pers., depressum Bon., bovista Linn.
Bovista plumbea Pers.
Scleroderma vulgare Fr., verrucosum Pers.
Rhizopogon luteolus Tul.
Ithyphallus impudicus (Linn.)
Mutinus caninus (Huds.) Fisch.
Puccinia poarum Niel.
Phragmidium rubi (Pers.).
Uredo mulleri Schröt, *Woolmer.*
Sphacelotheca hydropiperis (Schum.).
Claviceps microcephala (Wallr.), Wint.
Cordyceps militaris (Linn.), ophioglossoides (Ehr.), capitata (Holmsk).
Hypocrea rufa (Pers.).
Nectria cinnabarina (Tode) Fr.
Hypomyces rosellus (A. & S.) Tul. *Woolmer,* torminosus (Mont.) Tul.

Xylaria hypoxylon (Linn.).
Ustulina vulgaris Tul.
Daldinia concentrica (Bolt.).
Hypoxylon coccineum Bull., fuscum (Pers.) Fr.
Rhytisma acerinum (Pers.).
Rhopographus Pteridis (Sow.) Wint.
Diatrype stigma Fr.
Chaetomium elatum Kunze. *Inval.*
Melanomma pulvis-pyrius (Pers.) Fckl.
Podospora minuta Wint. *Woolmer.*
Sporormia minima Auersw. *Woolmer.*
Leptosphaeria doliolum Ces & De Not.
Elaphomyces granulatus Vitt., variegatus Fr.
Hypoderma virgultorum D.C., Desmazieri Duby. *Woolmer.* New to Britain.
Dichaena quercina (Pers.) Fr.
Helvella lacunosa Afz.
Geoglossum glabrum Pers.
Leotia lubrica Pers., acicularis Pers.
Peziza vesiculosa Bull., badia Pers., succosa Berk.
Otidea leporina (Batsch) Fckl., aurantia (Pers.) Mass. luteo-nitens (B. & Br.) Mass.
Plicariella trachycarpa Rehm. (= Curreyella trachycarpa Mass.*)
Humaria humosa (Fr.) Sacc., granulata (Bull.) Sacc.
Lachnea hemispherica Gillet.
Dasyscypha virginea (Batsch.) Fckl., ciliaris (Schrad.) Sacc. *Woolmer.*, calycina (Schum.) Fckl.
Tapesia aurelia Phil.
Chlorosplenium aeruginosum De Not.
Ciboria ochroleuca (Bolt.) Mass., echinophila (Bull.) Sacc.
Helotium citrinum Fr., virgultorum (Vahl.) Karst., var. fructigenum (Bull.) Rehm., cyathoideum (Bull.) Karst. *Inval.*, fagineum (Pers.) Fr.
Mollisia cinerea (Batsch) Karst.
Ascophanus carneus Boud. var. testaceus Mass.
Ascobolus aerugineus Fr., furfuraceus Pers., immersus Pers.
Saccobolus neglectus Boud.
Coryne sarcoides Tul.
Bulgaria polymorpha (Œder) Wetts.
Cenangium abietis (Pers.) Rehm. *Woolmer.*
Scleroderris livida (B. & Br.) Mass.
Spinellus fusiger (Cke.) Van Teigh.
Sporodinia grandis Link.
Syzygites megalocarpus Ehrb.
Sphaeropsis pinastri (Lév.) Sacc.

*Curreyella is a Pyrenomycete A.L.S.

Sphaeronemella fimicola March. *Woolmer.*
Dinemasporium graminum Lév.
Penicillium glaucum Link.
Rhinotrichum Thwaitesii B. & Br.
Botrytis cinerea Pers.
Trichothecium roseum Link.
Tubercularia vulgaris Tode.
Fusarium roseum Link.
Ptychogaster albus Cda.

*Mycetozoa.**

Physarum nutans Pers.
virescens Ditmar and var. nitens Lister, developed from plasmodium. This is *the first British specimen* we have recorded *of the var. nitens*, all our other specimens are from N. America, except one from Bohemia.
Fuligo septica Gmel., ochracea Peck., developed from plasmodium. This is *the third British record.*
Craterium pedunculatum Trent., leucocephalum Ditmar.
Leocarpus vernicosus Link.
Chondrioderma Michelii Rost.
Didymium effusum Link., nigripes Fr., Clavus Rost., on straw *Marley Heights*, farinaceum Schrad.
Spumaria alba DC.
Stemonitis fusca Roth., ferruginea Ehr.
Comatricha obtusata Pers., typhoides Rost.
Amaurochaete atra Rost.
Cribraria aurantiaca Schrad., argillacea Pers.
Licea flexuosa Pers.
Enteridium olivaceum Ehr., var. licioides Lister.
Tubulina fragiformis Pers.
Trichia fallax Pers., persimilis Karst.
Arcyria albida Pers., punicea Pers., incarnata Pers.
Lycogala miniatum Pers.

* This list with accompanying notes was kindly furnished by Miss Gulielma Lister, F.L.S., and Mr. Arthur Lister, F.R.S.

COMBATING THE FUNGOID DISEASES OF PLANTS.

By R. H. Biffen, M.A.

PRESIDENTIAL ADDRESS.

Ladies and Gentlemen,—

The subject I have chosen to address you upon this evening is the somewhat technical one of the methods at our disposal for protecting our cultivated plants from the attacks of parasitic fungi. I have chosen this branch of mycology in the first case because it is one with which I have a certain amount of practical experience and also because I think that if an economic side is given to our work it is likely to prove of more general interest than if we confine ourselves solely to the finding and describing of rare or new species. My work as a botanist concerned for the most part with our cultivated crops continually brings me into contact with the problems of plant diseases, and I have gradually become convinced that it is one of the duties of the mycologist to obtain, as far as possible, a knowledge of the life stories of the commoner parasites and methods of checking their spread for the benefit of those who would save their crops from their devastating influence.

It has I know been objected that we have no right to attempt to upset the balance of nature by limiting the spread of these parasites, but the objection loses weight when one recognises that the crops we attempt to save cannot be looked upon as natural in the same sense as the wild plants of our flora. They are grown under conditions which do not occur in nature, and left without man's fostering care they would soon be extinct. Under such circumstances the risk of upsetting a very problematical balance is one which does not appeal much to the cultivator.

The subject is essentially a modern one. Though the existence of disease in plants was known from the earliest times the facts of parasitism were so imperfectly understood that satisfactory attempts to prevent epidemic outbreaks of any fungus were practically impossible. With an increase of our knowledge of the relationship of host and parasite the possibilities of the subject have become evident, and now, when we come to consider the shortness of the period involved, it must be admitted that we have at our disposal a fair assortment of methods for com-

bating the spread of disease. All cases cannot be satisfactorily dealt with, but in the majority the evil can at least be mitigated to some extent.

The economic importance of these plant diseases depends on the intensity of the attack and the value of the host plant. A cereal crop for instance may be but slightly attacked by one of its rust parasites and comparatively little damage may result, whilst a serious attack may not only mean a greatly diminished yield but also a serious depreciation in the value of the grain.

In the same way *Phytophthora infestans* may in some seasons be practically harmless, whilst in others, as in 1845, its attack may be so virulent that the potato crop is completely destroyed throughout the country. Obviously such external conditions are beyond our control, nevertheless much can be done to minimize the losses these fungoid parasites cause.

When we attempt to obtain some idea of the actual magnitude of such losses we can only find the most fragmentary data, yet they are quite sufficient to show us the importance of the issues at stake. A few well-worn statistics may be quoted here. According to the report issued by the International Phytological Commission in 1893 the cereal rusts alone cost Prussia over £20,900,000; in other words, one-third of the total crop of the country was destroyed. These same rusts cost Australia £2,500,000 in 1890-1. In the following year, 1892, a vine disease was responsible for the loss of a similar amount in California. When one adds to these figures the unrecorded losses due to potato disease, to smuts in cereals, to decay in fruits, in timber and so on, one begins to realize that the year's bill must be an enormous one. Yet one often hears the farmer or horticulturalist say that such and such a disease is of no practical importance. It would be better with them if this were really the case, but those who have the opportunity of watching their crops are driven to recognise that the small and generally unrecognised losses in their cumulative results are as serious as those for which statistics are obtainable.

In countries where the importance of the proper care of farm and garden crops is recognised such knowledge has led to State supervision of the cultivation of certain crops and regulations are issued for combating the parasites which attack them, penalties being imposed for the non-fulfilment of the precautions demanded. How far State interference is practicable in this country is an open question, though of its value in some cases there can be no doubt. Without discussing the possibilities of checking the importation and wholesale dissemination of new parasitic forms from abroad, which as a matter of fact is prevented in the case of farm animals, let us turn to the efforts actually made in this country to minimize the losses due to the

attacks caused by parasitic fungi. Unfortunately there is little to record. We find that our Board of Agriculture publishes and distributes from time to time brief pamphlets dealing with some of the more important diseases, while various local experimental stations carry out similar work for their own particular districts. What little research work on the life histories of these parasites and the most practicable methods of keeping them within reasonable bounds is carried out in this country we owe to scientists whose time as a rule is already occupied with educational matters. One can but hope that the future will bring some recognition of the nation's losses year by year caused by epidemics which are frequently preventable and that this may lead to the setting aside of a sum of money, small in proportion to these annual losses, for the further study of this subject. Of the true economy of such a course there can I believe be no doubt.

The methods at our disposal for combating plant diseases may be grouped under three headings:—

(1) Avoiding the conditions known to be favourable for the spreading of the disease.
(2) Destruction of plant tissues containing the resting forms of the fungus.
(3) Exterminating the parasite without injuring the host plant.

(1) In many cases we have to admit that it is impossible to avoid the conditions which we know are favourable for infection and the matter is complicated by the fact that these conditions are not the same for all fungi. For instance the atmospheric conditions which determine whether *Phytophthora infestans* shall become epidemic or not are altogether beyond our control. Nevertheless we can frequently choose situations for planting in which unfavourable conditions are not likely to occur. A classical example of this is afforded by the history of the epidemics of larch disease *Dasyscypha calycina (Schum.) Fuckl.= (Wilkommii)* Hartig—a fungus we have already found during our excursions. This parasite, although occurring on larches in their Alpine home does little damage to them there. But when larches were extensively planted in the lowlands, in spite of the fact that judging from their vigorous growth all conditions were favourable for their culture, the fungus made rapid headway and became at once a pest to be seriously reckoned with. The explanation was given by Hartig. In the Alps the larch sheds its foliage and remains dormant until May, when the buds open rapidly and the foliage matures in the course of a week or two. In the lowlands, on the other hand, the buds begin to open far earlier—often in March—and exposed as they

are to spring frosts, to cold winds, etc., the foliage does not develop fully for some six or eight weeks. The result of this tardy development is that the immature foliage is exposed for a lengthy period to the attacks of certain insects such as the larch aphis *(Chermes laricis)*. As the fungus can only find its way into the larch through wounds in its tissues one can readily understand that the trees growing in the lowlands are far more liable to its attacks than those of the highlands where the foliage is only in a sufficiently succulent condition to tempt the aphis for a brief period.

A second example is provided by *Pythium de Baryanum* the fungus responsible for the "damping off" of seedlings. This parasite is capable of attacking many kinds of seedlings and rapidly reducing them to a slimy mass. It is particularly common on the seedlings of Cruciferous plants, the favourite host being perhaps the common cress. If seed beds of this plant be thickly sown and kept thoroughly moist one can generally count on an outbreak of the disease. By simply altering the external conditions by growing the seedlings in a dry atmosphere the ravages of this fungus can readily be kept under control. This same factor, excessive moistness of the atmosphere is responsible for the rapid spreading of many of the diseases which attack plants cultivated under glass. Many a crop of cucumbers for instance has been utterly destroyed by gardeners failing to realize that a thoroughly moist, warm atmosphere is far more favourable to the growth of *Botrytis cinerea* than that of the crop they intend to grow.

Under this same heading of avoiding conditions known to be favourable for the spread of fungoid diseases we may include the subject of the proper treatment of wounds in plant tissues. A considerable number of fungi can only bring about the infection of their host plants through abrasions in the cuticle or the corky protective layers. As long as these tissues are sound the plant remains altogether free from the attacks of such wound-parasites. A broken branch, bruises caused by hailstones or by the rubbing of animals, etc., the wounds caused by pruning, by careless fruit-picking and so on, may all serve as points of entry for a fungus. Such wounds, if small, are readily healed by the formation of callus, but where large snags are left by breakages or by bad pruning, the healing process may take several years to complete, and meanwhile the exposed surface is liable to become infected by various wood-destroying parasites. Any exposed surfaces should therefore be treated in such a way as to reduce this chance to a minimum. The best method is to pare the exposed surface until it is smooth, dress it with a dilute solution of corrosive sublimate, and when this has thoroughly dried in to cover the wound with hot tar.

Where possible this operation should be carried out in the autumn, and as the dressing is liable to crack it should be examined from time to time and renewed if necessary. The smaller wounds produced by pruning cannot be treated in this way owing to the necessity of pruning back to a bud which would be killed by such treatment. These small wounds frequently form the favourite place of entry for *Nectria ditissima*. Fortunately it is now becoming recognized that the wholesale and indiscriminate pruning to which our fruit trees are generally exposed is unnecessary. This fact will tend to keep down to a considerable extent the dreaded canker fungus. The one other method we can consider now of avoiding conditions which are likely to bring about infection is the one employed in combating the spread of some of the heteroecious rusts. For such fungi an alternative host plant is essential for their complete development, certain spore forms being produced on one host plant A which then infect the second host plant B. Their life cycle is only complete when the host A is again infected through the spores produced on B. By breaking the life-cycle one can obviously check the extended spread of such parasites. If A is to be cultivated, then it is only necessary to keep down the alternate host plant in the immediate vicinity. Numerous examples of the practical application of this principle might be quoted. Garden peas, for instance, are attacked by a rust *(Uromyces pisi)* which forms an aecidial stage on spurges. The spores produced on this host pass in turn to the cultivated garden peas, reproducing the well known disease. A second example is provided by *Gymnosporangium Sabinae*. This rust is common on pears, the aecidial stage being formed in abundance on the foliage and fruits. The crop produced on infected trees is light and as a rule unsaleable. The teleutospore stage occurs on the Common Savin, where it forms characteristic jelly-like masses. If these hosts in the immediate neighbourhood of the pears are destroyed then, as the fungus cannot complete its life cycle, the epidemic ceases. To secure satisfactory results by destroying the alternative host plant it is essential that the whole neighbourhood should be cleared. As this generally demands a certain amount of cooperation it cannot always be relied upon to give altogether satisfactory results.

Setting aside as an obvious predisposing cause the using of soil for potting purposes which has already carried a diseased crop we may turn to a consideration of the best methods of disposing of tissues known to be diseased. The ideal method of course is to burn all such plant remains. In practice, however, this is by no means as simple as it would appear to be at first sight. One cannot for instance readily burn all the diseased haulm of a crop of potatoes, neither can a farmer afford

to waste in such a fashion all the diseased tubers, however desirable the process may be from the theoretical standpoint. In practice the diseased haulm is as a rule thrown up in heaps to form manure. Under the conditions obtaining in these heated heaps the spores appear to be—for the most part at all events—destroyed. Nevertheless care must be exercised even here, for it is an indisputable fact that the spores of many of the smut family will actually germinate under such conditions, giving rise to fresh spore-forms capable of bringing about further infection. If the smutted material must be disposed of by this means then the heaps should be allowed to lie as long as possible. The advantage of this is well shown in a series of experiments carried out by Wollny in Munich. He shook up grains of maize—a crop not grown in that neighbourhood—with the spores of a smut which attacks it, and then sowed them in plots previously dressed with fresh or with old manure. Control plots received no dressing. These latter produced no diseased plants, those with the old manure a few, and those with the fresh manure a very considerable percentage. The fresh manure had provided the fungus spores with a medium well suited for their development. In other cases the diseased crop has to be disposed of as food for stock, *e.g.*, potatoes infected with *Phytophthora* or swedes with the "finger and toe fungus" *Plasmodiophora brassicae*. The plant remains then again find their way back to the soil. The assumption underlying this procedure is that the fungus spores are killed during their passage through the animal's digestive system. In the majority of cases this is undoubtedly true, but the fact should not be lost sight of that it has been conclusively proved that a preliminary digestion is actually necessary for the germination of the spores of some fungi. At present though we know of no such case amongst the common plant parasites, but this of course is no guarantee that such cases do not occur. At first sight the undoubted spreading of "finger and toe" might appear to be an example of a fungus whose spores germinate readily after their passage through an animal's body. More careful investigation shows that this is not really the case, for in feeding the diseased tissues to stock fragments are sure to find their way into the litter and thence on to the land, where, given a suitable host plant, they soon reproduce the disease. The most rational way of disposing of such a crop is to feed it to stock on grass-land where, as there are no *Cruciferæ* present, there is no possibility of the fungus spores coming into contact with the root system of a suitable host.

We now come to what is perhaps the most practical side of our subject—the methods at our disposal for destroying parasites without injuring the host plant. The means depend upon

the life history of the fungus. Starting with such fungi as the smuts which attack the cereals in the seedling stage we know that the infection is brought about by spores which adhere to the seed coats and consequently are sown with the grain. If one could in any way destroy these lurking spores then the crop would be free from infection. Many methods have been suggested for this purpose and some have actually been employed for centuries. One of the oldest of these is to soak the grain in strong brine a short time previous to sowing. This process kills many of the spores without damaging to any extent the germinating capacity of the grain. In later times this process has been modified by employing steeps of copper sulphate in place of the brine. Still more recently the employment of formalin or of lysol has been recommended. These various steeps have proved very satisfactory for the prevention of the cereal smuts, but they bid fair to be replaced by Jensen's hot water method. The biologic fact upon which this process is based is that the smut spores are killed on being exposed to a temperature of 132 F., which however is not injurious to the grain. In practice a quantity of about a bushel is placed in some readily permeable receptacle and then dipped in a vessel of water at a temperature of 120 F. The grain is then thoroughly stirred up so that every part of the bulk is exposed to its heating action. After this preliminary warming the vessel is transferred to water at a temperature of 132 F., and by alternately lowering, raising and twisting, the whole mass of grain is heated to a temperature within a degree or two of this limit. Should the temperature fall during the ten minutes this process continues it should be brought back to its proper level by adding more hot water. The one essential point to notice is that the temperature should be kept as near to 132 F. as possible. A slightly higher temperature may result in killing the grain. The superiority of this process is no doubt due to the fact that one can readily raise the whole bulk of the grain to the desired temperature, though it is difficult to make certain that every portion is wetted in the steeping process. Smut spores in the groove of a grain of wheat or in the brush of hairs at its apex might well escape the action of a copper sulphate steep owing to the difficulty of expelling the air bubbles forming in these positions.

In spite of the simplicity of the methods described smut still flourishes in the cereals and one can never hope to see it thoroughly eradicated until the seedfirms take the matter in hand and guarantee their seed free from lurking spores. The additional cost to the buyer would be so insignificant that the idea might well be put into practice at once. The various methods of attacking lurking spores will in the near future find

an extended application, for it is indisputable that the spores of many of our fruit tree pests such as *Monilia*, various *Erisyphe*, etc., rest during the winter in the crevices of the bark, or even between the bud scales and in lichens on the trunks, where they might readily be disposed of by the thorough application of fungicides. Under such circumstances there need be no hesitation in employing solutions which in the case of an actively growing tree might do more harm than good. We no longer have to consider, for instance, the scalding effect of some of the commoner reagents employed on the foliage. Thus the bark of a resting tree may safely be sprayed heavily with a ten per cent. solution of ferrous sulphate without experiencing any ill effects. If on the other hand this solution was applied to a tree in full activity the foliage would be destroyed.

Many of our worst plagues cannot unfortunately be attacked in so simple a fashion, and methods have to be resorted to for exterminating the parasite or its reproductive spores whilst it is in active growth on the host plant itself. For this purpose various fungicides are employed either in a liquid or a solid state. In such cases as the diseases brought about by the mildews *Erisyphe*, *Sphaerotheca*, *Phyllactinia*, etc., where practically the whole of the mycelium is on the surface of the host plant, the direct destruction of the fungus is an easy matter. For this purpose flowers of sulphur, either alone or mixed with two parts of fresh lime, may be dusted over the diseased portions of the plants, special brushes or bellows being made for the process. The dressing is an effective one, but its mode of action is not yet understood; it may be merely mechanical or it may be that toxic substances are produced in minute traces which kill the mycelium outright. Among the parasites which may be destroyed in this way are the grape mildew *Uncinula spiralis*, the rose and peach mildew *Sphaerotheca pannosa*, the hop mildew *S. castagnei* and so on.

Where deep seated mycelia like those of the rusts or of the Peronosporeæ and various Ascomycetes have to be dealt with liquid fungicides may be employed more satisfactorily. In such cases attention has to be directed to the crops of spores the mycelium produces rather than to the direct destruction of the mycelium itself. From time to time numerous fungicides have been recommended. For the most part they are preparations of copper or iron salts, less frequently permanganate of potash, sulphide of potassium or lysol are employed. None of these bid fair to surpass in general usefulness the original preparation of copper sulphate and lime known as "Bordeaux mixture." This was discovered accidentally, and we have to thank Millardet for the instantaneous recognition of the possibilities it opened up. He applied it first of all to vines, and finding it

satisfactory for checking the ravages of mildew applied it to the potato crop, where it was found to keep the Phytophthora under. Since his preliminary experiments its use has spread almost indefinitely, and many modifications of the original formula for preparing it have been suggested. If I may judge from the number of unsatisfactory cases where Bordeaux mixture has been used it appears to me that its proper method of preparation is still far from generally understood—a view borne out by the incorrect formulæ so often given in our horticultural papers. The most satisfactory mixture for most purposes is that containing 6lbs. of copper sulphate and 4lbs. of lime in 50 gallons of water. To secure the best results with this several precautions must be observed. In the first case the lime must be freshly slaked; a small quantity of water should then be added to it and the lime should be allowed to crumble down to a powder. When in this condition a little more water is to be added and well stirred in so that a thick cream free from any lumps is formed. After adding a quart or so of water and again well stirring the liquid may be diluted down to 25 gallons and then mixed with the copper sulphate previously dissolved in another 25 gallons of water. Whilst mixing the two solutions should be thoroughly stirred together. If prepared in this way a bluish precipitate of a curious starchy nature is formed which settles down very slowly. A mixture giving a granular precipitate which settles rapidly may be considered to be useless. Many of the recipes include such substances as treacle or soft soap, the object of these additions being to make the mixture adhere to the foliage better. Their employment is but an admission that the mixture is not properly prepared, for it will adhere perfectly if this starch-like precipitate is formed. Numerous effective forms of spraying machines for applying the mixture can now be obtained. The one point to which attention should be directed in spraying is the fineness of the spray. The more mist-like it is the better the plants can be coated with the fungicide.

Bordeaux mixture is now employed in combating the majority of the commoner plant diseases. Thus it is used on the large scale for the potato disease, hop and vine mildews, various fruit diseases such as scab in apples and pears and so on. One peculiarity in its effects may be noted here, that is that in certain cases the employment of Bordeaux mixture results in the sprayed plants retaining their foliage for a longer period than they would normally. This is more particularly the case with the potato. In consequence of this the plant has a longer assimilating period and the crop is proportionately increased. This increase is as a rule more than sufficient to repay the cost of spraying, a fact which should prove a powerful argument for

further extending the application of measures for checking the spread of potato disease.

In very few cases does it appear to be possible to entirely exterminate the deep seated mycelium of a parasitic fungus by merely cutting out the diseased areas of the host plant. Where as is the case with certain *Exoasci* the perennial mycelium grows forward with the host plant, pruning back beyond the point of infection frequently gives satisfactory results. The same, though to a lesser extent, is true of the apple canker *Nectria ditissima*. If, however, one attempts to get rid of the mycelium of such a fungus as *Polyporus hispidus* growing in the trunk of an apple tree by excising the diseased area one rarely succeeds. In such cases the attacks are not noticed until the fungus has penetrated throughout the tree trunk, when it begins to form its sporophores. Should these be removed the mycelium soon gives rise to a fresh crop.

Setting aside for the time prophylactic treatment—in itself always more or less troublesome and often costly—we may turn to consider fresh aspects of the problem of treating plant diseases. The hope of many is that the near future may bring us races of plants not susceptible to the particular diseases they now suffer from. Evidence for the possibility of this is gradually accumulating. We know for instance that if a large number of the varieties of any plant are cultivated under the same conditions so that all are freely exposed to the same chances of infection that the incidence of the disease is not the same in all cases. Some varieties are found to be especially susceptible to it, whilst others remain more or less free from disease. A repetition of the experiment season by season gives the same result, so that we may divide the varieties up into susceptible and immune forms, between the extremes on either side, many intermediates being met with.

Other things being equal the varieties least susceptible to disease should be cultivated. Unfortunately there are many points to be considered in choosing varieties for general use and we cannot guarantee that the disease-resisting type shall be satisfactory in all respects. This is the case for instance with the potato known as Evergood. Its introduction would have solved the problem of preventing potato disease to a great extent had it not been for the fact that combined with its undoubted disease resistance were bad eating qualities. The question which then arises is whether it is possible to do away with these bad qualities and still retain the power of resisting the attacks of fungi. That this is within the scope of the plant breeder is I think possible, though many difficulties are still to be surmounted. Granting the possibilities of this the difficulty has to be faced that the parasite may gradually adapt itself to

the new conditions provided by the immune varieties and so break down their mode of defence. Many say that the old varieties of the potato are far more susceptible to the attacks of *Phytophthora* than the newer ones, the impression being general that varieties wear out. I have tried in vain to satisfy myself that this is the case and I am beginning to question whether it is true. Certainly many of the newer varieties of this plant are as susceptible as the older ones, a fact which though not conclusive in itself does not fit well with the conception that the new form is necessarily superior in disease resistance to the older. Be this as it may the attempt to raise immune types of our commoner crops is one which is well worth the making.

NOTE ON SPHAEROPSIS PINASTRI SACC.

By Annie Lorrain Smith, F.L.S.

Sphaeropsis Pinastri Sacc.

A fungus on pine leaves which was described by Léveillé in Ann. Sci. Nat. 1846, p. 282, as *Phoma Pinastri* has since been placed by Saccardo (Syll. III, p. 300) in the genus *Sphaeropsis* on account of the brown simple spores. Léveillé in his original description says: "Les spores sont grosses, ovales, allongées, opaques, sans cloisons avec l'apparence d'une sporidiole globuleuse à leur interieur." Saccardo incorporates this description but adds the size of the spores as $10 \times 6\text{-}7\mu$, which indicates rather a small spore for this genus.

Another species, *S. Ellisii* Sacc, recorded from America on corticated branches of *Pinus silvestris* has also large spores measuring $30 \times 12\mu$ or $35\text{-}40 \times 15\mu$, which correspond evidently with the "spores grosses ovales" of Léveillé's *Phoma pinastri*. In the recently published volume of Rabenhorst's Fungi Imperfecti, Allescher has included both species under *S. Ellisii* with a var. *Abietis*, which grows on the cone scales of *Abies pectinata*. He gives the same spore measurements as for the American species. During the fungus foray at Haslemere a specimen was collected in Woolmer Forest on pine needles, the spores of which are large, oval and brown, and measure up to $40 \times 15\mu$. It corresponds with *Phoma pinastri* as understood by Léveillé and the name *Sphaeropsis pinastri* should have been retained rather than *S. Ellisii*. The epidermis of the leaf was split by the fungus. Léveillé says of his species that the epidermis was torn in a star-shaped manner, but that difference is certainly not specific.

Sphaeropsis pinastri (Lév.) has been already recorded as a British species growing on leaves and cones of *Pinus sylvestris* at Eastbourne.

MYCOLOGY AS A BRANCH OF NATURE-STUDY.

By John Frederick Rayner.

By way of preface to a plea for Mycology as a branch of Nature-study, it may be well to say a word about Nature-study itself. The rush to the towns, that portentous phenomenon of these latter days, has had far-reaching consequences, mostly bad. I do not forget that civilization, as the very word implies, came from town life, but civilization, like other things, may be bought at too high a price. Many observers are becoming alarmed about it. So lately as 1850 at least half of our population were engaged in agricultural pursuits, but now—we have it on the authority of one who cannot at any rate be called an alarmist, the Duke of Devonshire—77 per cent. labour, or do not labour, in the towns. Small wonder if so immense a transmigration should call forth the warnings of our modern Cassandras. It is the subject of anxious discussion at Church Congresses, at May Meetings, at Medical Association gatherings, in Parliament itself. It is declared to be laden with all manner of evils, physical, mental, moral and economic. The doctors tell us we are degenerating for want of pure air, our boasted sanitary improvements to the contrary notwithstanding. They say that one out of every five is tuberculous, that our jaws and our lungs are shrinking, our hair and teeth leaving us, our nerves shattered, the percentage of suicides increasing year by year; and as for lunacy, a problem of the near future will be the housing of the mentally afflicted. Some point to the declining birth-rate as a sign of national decay; others remind us that in spite of successive lowerings of the recruiting standard, sixty per cent. of candidates for military service have to be rejected as physically unfit. Our spiritual guides lament the frivolity of the age, the craving for change and excitement, the sensational and scrappy press, the garish and crowded public-house, the monstrous "gates" for professional football. Our politicians are aghast at the decay of agriculture, the lack of labourers, the inertia and want of enterprise on the part of those who still remain on the land, while the problem of the urban unemployed impels to novel and revolutionary legislation. But the Unemployed Act is fortunately only one of many signs of counteraction: witness the Garden City movement, the fashion

of holidays under canvas, the agricultural colonies of the Salvation and Church Armies, the enormous vogue of Pastor Wagner's "Simple Life," the great multiplication of books and periodicals dealing with gardening, botanical and rural topics, and last, but not least, the adoption of Nature-study in our schools. Now some of these evils may be exaggerated, some of the remedies futile, but we may claim this for Nature-study, that it gives at least a hint to the rising generation that there are other objects of interest in the world besides those which towns afford. It stimulates a love for the things of the country without which it were vain to hope that our people will be persuaded to retrace their steps countrywards. But I waste time in preaching to the converted. Nature-study has come to stay, and you and I are glad. My business this evening is to impress upon schoolmasters and all concerned the claims of our own pet subject, Mycology to wit.

Nature-study as frequently, I might perhaps say generally taught, resolves itself into Botany, by reason chiefly of the greater accessibility of material than either Zoology or Geology can offer; and the botany of our schools and Nature-study classes is mostly restricted to the flowering plants, often indeed only to the more conspicuous of these—the grasses, sedges and rushes being frequently neglected, a neglect of which indeed not a few among older botanists are found guilty. Now I wish to show cause why these boundaries should be enlarged. I do not mean to infer that all possible work within these boundaries has been or is being done, but at any rate the study of the flowering plants is limited by the season, and that season is succeeded by the season of Cryptogams. On the arrival of the "glorious First" the Phanerogams can offer little that is fresh to the wandering gaze of the youthful botanist, unless it be materials for the study of seed-dispersal or specimens for the examination of abscission-layers—but now come troops of new and strange forms of plant-life. I put aside for the present the Mosses, the Lichens and the Algae. Their structure and life-history have indeed attractions of their own, but call for the regular use of the compound microscope, and are hardly, to my thinking, so well fitted to engage the attention of the young naturalist as are the larger Fungi. Besides the "infinite variety" in form and colour of the Fungi, besides the large size, the fleshy substance, and the exceeding beauty of very many of them: besides the suddenness of their appearance and the rapidity of their growth, there is their strange and mysterious character. The student learns that there are plants without leaves, roots or flowers, plants devoid of that distinctive characteristic of plant-life, chlorophyll—a group unique on that account. He finds himself dealing with structures whose cell-formation proves their kin-

ship with his familiar friends the flowering plants, and yet which feed, as he himself feeds, on matter previously organised. Such a revelation, which all who have acquired the first elements of biology may receive, cannot but enlarge his conceptions of the vast hierarchy of Nature. But short of this, the youngest, the most thoughtless, will find something pleasurable in noting the obvious external features of Fungi: the plan of their multifarious forms, the meaning of their different parts, and the system of their classification. When one hears, as is not infrequently the case, some naïve expression of astonishment that these queer fragile objects which spring up at our feet for no other purpose it would seem than to offer a mark for a slashing walking-stick, have each and all of them a name and a place in the universe as definite if not as important as that of the heedless destroyer, one begins to recognise that Mycology has in it something of almost ethical import.

Then there is their edibility. From ethics to gastronomics is somewhat of a descent perhaps, but the appeal of the palate is not to be altogether disregarded, and may even bear its own particular lesson: new foods may lead to a reconsideration of the whole question of foods and feeding, which some say we English stand in great need of. Be that as it may, people are quite ready to listen when one talks of the toothsome savours and wholesome qualities of the edible Fungi. Not that they are always so ready to try them; they have heard of the poisonous species, and, like certain—shall we say mythical?—beings, "they believe and tremble." But after an experiment on the vile body—of the teacher, I mean—seeing him eat fungus and not thereafter incontinently expire with his feet in his armpits, they gather courage, taste, and are converted. This I say from an instructive if brief experience. For my part I cannot help talking about Fungi whenever I can get anyone to listen, and I find the culinary and esculent aspects of Mycology will generally command attention—and not only that side of the subject either, but afterwards at any rate, the more scientific side, and that which lends itself to Nature-study. Among sundry public discourses in which I have tested the attractions of Fungi, there was one I delivered—pardon this egotism, it illustrates the subject—to our Southampton Elementary Schools Head Teachers' Association, and they evinced no little professional interest in it. You see here some diagrams and figures which I made for the occasion. I do not disguise from myself that they are not exactly brilliant from the point of view of executive faculty or artistic merit—but here let me interject that I had, among other *pièces de conviction*, a large and varied assortment of spore-maps which came in for much wondering inspection and remark, especially when I smeared them with my finger to

prove them real, and not the product of the paint-brush or the printing press. As for the text of my lecture, which I compiled with a tyro's temerity, I fear it was no great thing either; yet the fact remains that the schoolmasters behaved as though they were more than commonly interested. So it was also with a gathering of students in training, and other audiences of the usual type of local scientific societies. My small experience, then, shows that Mycology is a very attractive topic, even when presented by an advocate so poorly equipped as your humble servant; handled by masters of the subject, such as are here to-night, it will, I feel assured, be found a popular and useful branch of Nature-study. Useful I think in a high degree if it can be made to help, in soever small degree, to open the eyes and minds of the young to the things of country life. I am not indeed unmindful, as I said at the beginning, of the good that has come and does still come from the life of the town. Liberty and learning had their birthplace within its walls. But town-life has, or is beginning to have, its drawbacks and its dangers —exaggerated in some quarters though we deem them to be— and at the very least we may urge that Mother Earth has more in her lap than the pavements can yield or the gas-lamps discover. We would persuade the rising generation that the hedgerow should not be altogether abandoned for the shop-window, or the hillside be forsaken for the music-hall. We would say to the young people that the country is full of interest and charm, that they will find the study of Nature fraught with a sweet and abiding refreshment, and finally that among Nature's rich store-houses there is one chamber, often unopened, but well worthy of at least a passing glimpse, full to the door of things quaint, curious and beautiful—the Fungus Flora of our native land.

FUNGI NEW TO BRITAIN.

By Annie Lorrain Smith, F.L.S., and Carleton Rea, B.C.L., M.A., &c.

WITH PLATES X. XI. XII. & XIII.

Sordaria (Philocopra) pusilla Mout. in Bull. Soc. Bot. R., Belg. 1886, p. 146.

Perithecia small, immersed, glabrous, thinly membranaceous, pale greenish; asci cylindrical or oblong, shortly stalked, 80-90 × 20-24μ, polyspored; spores ovate-subglobose, honey-coloured, then fuliginous, about 3·5μ in diameter.

On rabbit dung, in Ecclesall Wood, Sheffield, Spring 1903, Thos. Gibb, Naturalist, May, 1905, p. 139.

Herpotrichia nigra Hartig. Hedwigia xxvii. (1888) p. 13.

Mycelium blackish-brown, broadly creeping, furnished with haustoria, occupying and destroying the leaves; perithecia globose, black, ·3 mm. in diameter, furnished with a long deflexed hair at the base; asci elongate, 76-100 × 12μ; spores in two rows, 1—rarely 3-septate, constricted in the middle, 4-guttulate.

On leaves of conifers. Found on seedlings of Scots fir in Yorkshire, by W. A. Thwaites, of Masham.

Physalospora gregaria Sacc. Syl. Fung. I. p. 435. Fung. Ital. t. 432.

Perithecia densely gregarious, covered by the epidermis, globose, shortly papillate, black, white within; asci clavate, rotund, with a thick wall, shortly stalked, 8-spored; spores distichous, ovoid-oblong, 30-40 × 6-8μ.

On branches of *Prunus*, *Salix*, *Alnus*, and *Cornus*.

On *Salix* in Connemara, causing disease of the sets, by T. Johnson, Sci. Proc. R. Dublin Soc. X (1905) p. 153 with plate.

Tetradia salicicola nomine nudum, with plate (Sphaeropsideae).

Found by T. Johnson. A stage of *Physalospora gregaria* a disease of Willows. The spores are colourless, 3-septate.

On *Salix*, Connemara. Proc. R. Dublin Soc. X (1905) p. 157.

Macrodendrophoma salicicola nomine nudum, with plate (Sphaeropsideae).

Found by T. Johnson as a stage of *Physalospora gregaria*, a

disease of Willows. The spores are fusiform, 2-celled, colourless, 12 × 4·5μ, borne on branching conidiophores.

On *Salix*, Connemara. Tom. cit. p. 158.

Hypoderma Desmazieri Duby Hyst. p. 42, tab. 11, fig. 22.

Ascophores black, shining, scattered, on both sides of the leaves, innate, ovately convex, thinly covered by the epidermis, longitudinally striate, lips closed; asci broadly clavate, sessile, paraphysate, 8-spored; spores oblong or clavate-oblong, colourless, continuous, 15-22 × 2-3μ, rather narrower and more acute below.

On Pine leaves, Crediton, Devonshire, April 1905. A.L.S.

Discula Fagi Oud. Contr. Mycol. XIII. p. 53.

Perithecia imperfect, seated between the periderm and the cortical parenchyma; spores ovate, oblong ovate, or pyriform, oblong or acute at the ends, sometimes 2-guttulate 8-14 × 3-4μ.

On branches of Beech. Found on dying beech seedlings in Yorkshire by Mr. W. A. Thwaites, of Masham. Naturalist 1905 p. 189.

Pleurotus decorus Fr. Hym. Eur. p. 168, Fr. Syst. Myc. I. p. 108; Fr. Mon. p. 144; Fr. Ic. p. 60, t. 60 f1 and see pl. 10 hereof.

Pileus fleshy, brittle, convex then expanded or depressed, 5-12 cm. broad, often excentric, *yellow, covered with linear bistre fibrils that become black with age.* Stem 6-10 cm. long by 1·5-2 cm. thick, stuffed then hollow, often twisted and *covered with fibrils that blacken with age* Flesh thin, pale yellow. Gills adnate or sinuato-adnate, from 5-10 mm. broad, *golden yellow*, crowded, often separating from the pileus with age, edge uneven. Taste bitter. Spores elliptical 6 × 4-5μ, white, smooth with a large orbicular gutta.

Amongst heather on a rotten stock, in a fir plantation 700 feet above sea level, near Drumnadrochit, Inverness, 20th September, 1905, Mr. Angus Grant.

Easily distinguished from its allies by the bistre fibrils on the yellow pileus and stem becoming black with age and the golden colour of the gills.*

Inocybe rhodiola (Bres.) Mass. Monograph of the genus Inocybe, Annals of Botany, 1904, p. 486; Bres. Fung. Trid., p. 80, tab. 87 (forma gracilis); *Ino. frumentacea* Bres. Fung. Trid. p. 88, t. 200 (forma typica); *Ino. jurana* Pat. Tab. Anal., no. 551 (fide Bres.).

* This determination was kindly confirmed by Dr. C. B. Plowright, who had seen this species in Sweden.

Pleurotus decorus *Fr.*

West, Newman chr.

Lactarius spinosulus *Quel.*

Hydnotrya Tulasnei. *B. & Br.*

Ascus 210-22[illegible] 50 μ.

Orifice of pores.

5-6 x 4-5 μ.

Polystictus Montagnei *Fr.*

West, Newman chr.

"Pileus fleshy, campanulate then expanded and umbonate, fibrillosely cracked, centre even, rufous-chestnut or fuscous flesh-colour, 4-8 cm.; stem fibrilloso-squamulose, becoming glabrous, vinous, apex pallid, subfloccose, 5-8 cm. long, 1-1·5 cm. thick, stuffed; flesh white, vinous at base of stem. Gills crowded, sinuato-uncinate, almost free, edge fimbriate, white then yellowish umber, often spotted with brownish umber. Spores subreniform, smooth, 10-12 × 6-8μ, some 14-15 × 8μ; *large cells on edge of gills clavate or subfusoid* 50-60 × 12-14μ. Smell resembling meal."

(1) In a field in Willey Park in cart ruts and (2) on hedge-banks in a lane at Barrow, near Broseley, and (3) under a hedge, Broad Meadows, Benthall, Shropshire, September 1905, Mr. W. B. Allen.

The appearance of this fungus strongly suggests as if it had been accidentally dropped in claret and this intensifies with age. There are *no cystidia but only the large cells on the edge of the gills*, which measure 45-60 × 12-15μ. The spores vary from 9-10 × 5-7μ, whilst others measure 12-13 × 6-8μ.

Lactarius spinosulus Quél. Soc. sc. n. de Rouen 1879 no. 48, t. 3 f. 10 Cke. Hdbk. p. 316. Mass. Fungus-Fl. vol. III. p. 31, and see pl. 11 hereof.

Spores round × 7-8μ, echinulate, very pale ochre in the mass. On the ground under Birches and Spruce, Weston Firs, Wyre Forest, Shropshire, 5th October, 1904, Mrs. Carleton Rea.

Marasmius archyropus Fr. var. suaveolens Rea, see pl. 12 hereof.*

Caespitose. Pileus 4·5-6 cm. broad, flesh colour, becoming pale, convex then plane or depressed, *striate at the margin*, flesh thin, tough. Stem 6-7 cm. long, 2-3 mm. thick, cylindrical, slightly thickened at the apex which is paler, the residue reddish and everywhere covered with a white tomentose pruina, stuffed then hollow, twisted when dried for some days. Gills 6-8 mm. *wide*, ventricose, adnexed, separating, crowded pallid then fuscous. Spores white, globose 3-4μ. *Smell very pleasant like Marasmius oreades.*

Amongst fallen beech leaves, Grange Park, Swarraton, Hants, 30th October, 1904. C. R.

This differs from the type in the larger size and striate margin of the pileus, the wider gills and the pleasant smell like *Marasmius oreades*. *Marasmius Stephensii* B. & Br. is also characterized by the pleasant smell like that of *Marasmius oreades* but

* The cost of this plate has most generously been borne by the Rev. W. L. W. Eyre.

differs in the pileus becoming vinous red when bruised, the shining stem and distant gills. Fries in his Hymenomycetes Europaei at p. 469 cites *Stephensii* as a synonym for his *Marasmius terginus* Fr., but this is also characterized by a smooth shining stem and the spores are, according to Massee, elliptical 6-7 × 4μ. Quélet in his Fl. Mycologique at p. 319 identifies *Marasmius Stephensii* with his *Marasmius globularis* Weinm., but this certainly differs from *Stephensii* and the present variety in the globose campanulate umbonate pileus and the distant gills and the ovoid pruniform spores 8-9μ.

Polyporus benzoinus (Wnbg.) Fr. Hym. Eur. p. 554; Fr. Ic. 183 f. 2, Kalch t. 36. f. 1, and see pl. 12 hereof.

Very sweet scented and subimbricate. Pileus 9-12 cm. wide, 6-7 cm. deep, 10-20 cm. thick, *woody*, shell shaped but constricted at the base, fuscous-rubiginous, somewhat zoned, very rugose when dry and becoming darker. Tubes 6-10 mm. long, equal; orifice round or deltoid, and minute at first whitish then *ferruginous*. Flesh fuscous then pale wood. Spores *white* 4-5 × 2-2·5μ oblong, curved.

On a fallen Cedar tree, Swarraton, Hants, 17th January, 1905, the Rev. W. L. W. Eyre.

This species at first suggests a form of *Polyporus hispidus*, but a closer examination soon directs one to its true affinity. It is closely related to *Polyporus resinosus* but cannot be regarded as a variety of that species because according to Quélet the spores are ovoid brown 10-12μ, whereas the present species has white curved spores 4-5 × 2-2·5μ and is characterized by the very pleasant smell which it retains even when dry. Fries' suggestion that it might be a *Trametes* is also confirmatory of the identity of this species.

Polystictus Montagnei (Fr.). Hym. Eur. p. 530; Fr. Epic. p. 434. Quél. Jur. I. t. 17, f. 4 and see pl. 11 hereof.

Pileus 3-8 cm. broad, cyathiform, irregular, uneven, *zoneless*, ferruginous, *tomentose becoming smooth*, margin thin. Stem 2-3 cm. long by 5-9 mm. thick, unequal, ferruginous, pubescent. Flesh somewhat corky, ferruginous. Pores short, *large*, round, obtuse, edge entire, yellowish white then ferruginous. Spores 5-6 × 4-5μ ovoid, plum-shaped, punctate, hyaline. The whole plant, both externally and internally, is of a tawny cinnamon colour.

On the ground, near Grayswood Beeches, near Haslemere, Surrey, 1898, Mr. E. W. Swanton.

Easily distinguished from *Polystictus perennis* (Linn) by the zoneless pileus and large entire pores.

Marasmius chordalis Fr.

Polyporus benzoinus Fr.

Sparassis crispa (*Wulf.*) *Fr.* Sparassis laminosa *Fr.*

West, Newman proc.

Poria obliqua Pers.

On dead wood near Perth, 5th January, 1905, Mr. James Menzies.

The spores of this species are *white* when deposited in the mass; they are round and hyaline under the microscope and measure $\times 4$-5μ. This confirms Quélet's measurement and colour of the spores as set out in Fl. Myc. p. 379, but is opposed to W. G. Smith's view of the spores on p. 66 of the present volume.

Irpex candidus Ehrenb.

Snow-white, broadly effused, thin, separable, *arachnoid*, flaxy at the margin. Teeth subulate or compressed, thin, toothed.

On dead pine wood, Swarraton, Hampshire, 10th February, 1905, Rev. W. L. W. Eyre.

Characterized by its arachnoid consistency and snow-white colour.

Sparassis laminosa Fr. See pl. 13. hereof.

Yellowish straw colour, very much branched, 10-25 cm. wide and high, branches *laminar*, *patent*, spores white, round, $\times 8\mu$, granular.

On the ground, Woolmer Forest, Hampshire, 24th September, 1905.

Easily distinguished from *Sparassis crispa* (Wulf.) Fr. by the more laminar patent branches.

OFFICERS FOR THE SEASON 1905.

President: R. H. Biffen, M.A., The Gables, Histon, near Cambridge.

Vice-President: Professor H. Marshall Ward, D.Sc., F.R.S., F.L.S., &c., University Botanical Laboratory, Cambridge.

Hon. Secretary and Treasurer: Carleton Rea, B.C.L., M.A., 34, Foregate Street, Worcester.

Published 19th May, 1906.

THE EPPING FOREST FORAY.

1st to the 6th October 1906.

The tenth annual week's Fungus Foray was held in Epping Forest, where the members assembled at the Royal Forest Hotel, Chingford, on the evening of Monday, the 1st of October, 1906. A large and commodious room in the hotel had been secured as the headquarters, and the following specimens were put out on exhibition. *Lepiota metulaespora* B. & Br., from Leytonstone, by the President (Mr. Arthur Lister, F.R.S.), *Eccilia griseorubella* (Lasch), *Flammula inopa* Fr., *Helvella crispa* Fr. and *Rhizina inflata* (Schaeff.) Quél. from Scotland by Dr. W. Watson. *Boletus parasiticus* Bull., and *Rhizopogon luteolus* Tul. from the New Forest by Mr. J. F. Rayner, who also exhibited on behalf of Mr. J. Needham a specimen of *Lycoperdon favosum* Oud.* from Hebden Bridge. *Lepiota acutesquamosa* (Weinm.) Fr. *Tricholoma melaleucum* (Pers.) Fr., *Inocybe rimosa* (Bull.) Fr. and *Russula azurea* Bres. from Kew gardens by Mr. A. D. Cotton F.L.S., *Tricholoma bufonium* (Pers.) Fr., *Pholiota flammans* Fr., *Cortinarius* (*Phlegmacium*) *triumphans* Fr., *C.* (*Dermocybe*) *orellanus* Fr., *C.* (*Telamonia*) *bivelus* Fr., *Hygrophorus agathosmus* Fr., *Lactarius vietus* Fr., *L. spinosulus* Quél and *Boletus pachypus* Fr. from the neighbourhood of Pitlochry by the Hon. Secretary.

On Tuesday, the 2nd of October, the members left the headquarters punctually at 10 o'clock, and were driven to the north-eastern portion of the Forest that adjoins Piercing Hill. The drive through the Forest revealed its leading features, the pollarded Hornbeams, open grassy glades, moorland covered with heather, pools and swampy places, all intermixed with Beeches and Oaks. The search was first made under some Scotch Pines and a few fungi characteristic of such a situation were found there, and then after proceeding under the trees some more open ground was reached and carefully worked. The President next led them to the famous Ambresbury Banks, where there is an ancient camp which tradition asserts was occupied by Queen Boadicea. After the ramparts had been duly investigated the walk was continued to the Wake Arms, from

* See The Naturalist, February, 1903.

whence the members were driven back to the headquarters. The fungi collected were at once placed out on exhibition, but only *Naucoria myosotis* Fr. and *Scleroderris fagi* (Phillips) Mass. are worthy of note. In the evening at 8.30 at the headquarters the President presided over the annual general meeting for the election of officers for the ensuing year, when Miss Annie Lorrain Smith, F.L.S., was unanimously elected President; Mr. Arthur Lister, F.R.S., Vice President; and Mr. Carleton Rea, B.C.L., M.A., &c., Hon. Secretary and Treasurer. The Hon. Secretary then reported that he had, with the approval of their President, tendered to Mrs. H. Marshall Ward, on behalf of the British Mycological Society, their heartfelt sympathy at the irreparable loss that she and Science generally had sustained by the premature death of her husband, and assuring her that the memory of their late Vice-President would always be held in their greatest esteem and respect. Mrs. H. Marshall Ward in reply begged the Hon. Secretary to tender to the members of the British Mycological Society her best thanks and said that her husband was always very proud of the fact that he had been their President for two years and subsequently their Vice-President to the present time. The members strongly approved of what the Hon. Secretary had done on their behalf and resolved that the same should be duly set out in the report of that meeting. The invitation of their fellow member Professor M. C. Potter to visit Newcastle-upon-Tyne next year was cordially accepted, and the consideration of the invitations from the Rev. H. Purefoy FitzGerald, F.L.S., to select the neighbourhood of Wellington College, Berkshire, and Mr. Angus Grant that of Drumnadrochit were deferred until the next annual meeting. The date for the Newcastle-upon-Tyne foray was not determined, but it was not to clash with the meetings of The Cryptogamic Society of Scotland or The Yorkshire Union.† The Hon. Treasurer then reported that the sum of £25. 10s. 1d. stood to their credit at that date at the Post Office, and that since the last foray six ordinary members had been duly elected, namely, Mr. E. J. Sharpe, 130, Fenchurch Street, London; Miss Blanche Shadwell, of Trewollack, Bodmin; Mr. Gustav Natorp, of 70, Ennismore Gardens, London, S.W.; Mr. Leslie P. Newman, of Moor Hall, Shorley, Bishop's Stortford, Herts; the Rev. Walter Butt, Kempsford Vicarage, Fairford; and Edward Morell Holmes, F.L.S., F.R.H.S., of Ruthven, Sevenoaks.

The Hon. Secretary reported that early in January last The British Mycological Society was invited by Mr. F. W. Rudler, I.S.O., Hon. Secretary to the Corresponding Societies Com-

† The foray is now fixed for Monday, the 30th of September to Saturday, the 5th of October.

mittee of The British Association for the Advancement of Science, to apply to them for this Society to be put on the list of *Affiliated Societies*. In answer thereto he made the application, and on the 6th March, 1906, he received the announcement that The British Mycological Society had been placed on the list of *Affiliated Societies* "*in consideration of its local scientific work of an original character.*" This he considered very flattering and was sure it should act as a stimulus to all their members to continue to do if possible even better work. Miss A. Lorrain Smith had kindly undertaken to represent them at the recent meeting of The British Association in August last, and now they would have to decide who should represent them at the meeting of that body next year. It was unanimously resolved that their President elect (Miss A. Lorrain Smith) should be nominated to represent them, and their best thanks were tendered to her for having represented them at the York meeting. The question of life membership was next considered and after some discussion was adjourned sine die. Hearty votes of thanks were tendered to Mr. Arthur Lister for his services as President during the current year, to the Hon. Sec. and Treasurer, and to Mrs. Carleton Rea for painting the originals of the plates that appeared in their last Transactions, and to the Rev. W. L. W. Eyre for his generosity in bearing the cost of one of the plates. Mr. D. A. Boyd, of West Kilbride, Miss H. C. I. Fraser, F.L.S., and Miss E. J. Welsford, F.L.S., both of the Royal Holloway College, Englefield Green, Surrey, were then duly elected ordinary members of the Society. During the day the Rev. W. L. W. Eyre put out on exhibition an interesting example of *Merulius molluscus* Fr. from Swarraton, and Mr. W. B. Allen sent on from Benthall *Polyporus rufescens* Fr., *Trametes rubescens* (A. & S.) Fr. (new to Britain), and *Lycoperdon excipuliforme* Scop.

On Wednesday, the 3rd of October, the members were busy during the forenoon examining the finds of the previous day and at 12 o'clock hastened to welcome the members of the Essex Field Club, who were cordially invited to join in any of the forays during the week. On the arrival of Mr. B. G. Cole (Hon. Secretary of the Essex Field Club) the brake started for Great Monk Wood. This portion of the Forest was very carefully examined and the walk was continued through Little Monk Wood and by Mount Pleasant to the King's Oak Hotel at High Beach, where the brake was re-entered for the return drive. The most noteworthy species collected during the day were *Omphalia striaepilea* Fr., *Pleurotus septicus* Fr., *Pluteus hispidulus* Fr., *Pluteolus aleuriatus* Fr., *Polyporus cuticularis* Fr., and *Puccinia hydrocotyles* (Link) Plow.

In the evening the annual Club dinner was held at the Royal

Forest Hotel at seven o'clock, which was attended by Mr. Andrew Johnston (Chairman of the Essex County Council), and Mr. R. Miller Christy (President of the Essex Field Club). Afterwards at the headquarters the President (Mr. Arthur Lister) delivered his Presidential Address (see page 142), and exhibited the circulation in the plasmodium of *Badhamia utricularis* under the microscope. On Thursday, the 4th of October, the members breakfasted on some well cooked *Boletus edulis*, and subsequently continued their mycological investigations at the headquarters until after 12 o'clock. The brake was then taken to the Earl's Path, and the walk was commenced through Black Bushes and Debden slade to Loughton Camp, which the President informed the members was pre-Roman, being of very early British origin. Next a traverse was taken through a further portion of Little Monk Wood which had not been touched on the previous day, and this part of the Forest was carefully worked back to the King's Oak Hotel at High Beach, from whence the members were conveyed to the headquarters. No fungus of especial interest was gathered during the day's foray. In the evening at 8.30 at the headquarters the Hon. Secretary read a paper on "How to distinguish the species of British Lycoperda in the field," (see p. 157), illustrated by several drawings by Mrs. Carleton Rea; and also made some remarks on behalf of their member, Mr. W. B. Allen, on the differences between the species of *Trametes Bulliardi* Fr., *T. rubescens* (A. & S.) Fr., and *Daedalea confragosa* (Bolt.) Pers., specimens of which were handed round for inspection. These remarks Mr. Allen had promised to embody in a paper "A Note on Trametes rubescens" (see p. 161). The Hon. Secretary further handed round a drawing of an *Entoloma* new to science, which he had named *pulvereum* Rea, and also a drawing and original specimens of *Scleroderris bacillifera* (Karst.) Sacc. found on dead branches of Silver Fir by Mr. MacIntosh at Dunkeld, an addition to the British list. He also read a short note on "*Ozonium auricomum* Link" (see p. 166), which was followed by a discussion. Finally the paper on "How to distinguish the species of British Lycoperda in the field" was ordered to be at once issued to the members as a pamphlet. It was published on the 1st of November last.

On Friday morning, the 5th of October, a magnificent collection of rare fungi was received from their fellow member, Mr. Angus Grant, gathered by him in Rothiemurchus Forest. It included examples of *Armillaria robusta* (A. & S.) Fr. *Tricholoma equestre* (Linn.) Fr., *T. pessundatum* Fr., *T. militare* Lasch., *Volvaria volvacea* Bull., *Pholiota flammans* Fr., *Flammula astragalina* Fr., *Cortinarius* (*Inoloma*) *traganus* Fr., *Cantharellus cupulatus* Fr., *Polyporus leucomelas* (Pers.) Fr.,

Hydnum imbricatum Linn., *H. scabrosum* Fr., *H. aurantiacum* A. & S., *H. ferrugineum* Fr., and *Thelephora terrestris* Ehrh. At 12 o'clock the members left the headquarters and were driven to Honey Lane Quarters, where they left the brake and proceeded to explore the westward portion of the Forest back to High Beach. Near this spot some fine prostrate beech trunks were carefully examined and several interesting Mycetozoa, including *Physarum leucopus* Link. (first record for the Forest), *Enerthenema elegans* Bowm. and *Dictydiaethalium plumbeum* Rost. were found. The search was then continued via Fairmead Bottom on the way back to the Royal Forest Hotel. The following specimens were gathered during the day:—*Amanita spissa* Fr., *Mycena stylobates* Pers., *Irpex spathulatus* (Schrad.) Fr., *Tremella indecorata* Smrft., *Lycoperdon depressum* Bon., and *Sphaerotheca hydropiperis* (Schum.) De Bary. In the evening at the headquarters at 8.30 Mr. A. D. Cotton, F.L.S., read a very interesting paper entitled "Notes on British Clavariae" (see p. 163).

On Saturday, the 6th of October, just before the members dispersed, a person from the neighbourhood brought in some fine examples of *Lepiota rachodes* (Vitt.) Fr. and *Agaricus Elvensis* (B. & Br.) Mass. During the week's foray some 330 species and varieties were collected. Of this number over fifty are additions to a manuscript list of five hundred and forty species enumerated by Cooke and Massee of "The Hymenomycetal Fungi of Essex," which was furnished to the Hon. Secretary by Mr. B. G. Cole. These additions are denoted by an asterisk in the appended list. This result must be considered very satisfactory as up to the 2nd of October a prolonged drought for over three months had prevailed in the Forest. Miss A. Lorrain Smith subsequently reported that Mr. G. C. Hughes had handed to her a mould which on further investigation she found to be new to science and has named *Acrostalagmus galeoides* A.L. Sm. She herself gathered another rare mould *Didymocladium ternatum* B. during the foray, the second record of its occurrence in Britain.

Complete List of Fungi gathered during the Foray.

Amanita phalloides (Vaill.) Fr., mappa (Batsch) Fr. muscaria (Linn.) Fr., pantherina (DC.) Fr., rubescens Pers., spissa Fr.

Amanitopsis vaginata (Bull.) Roze.

Lepiota procera (Scop.) Fr., rhacodes (Vitt.) Fr, *amianthina (Scop.) Fr., granulosa (Batsch) Fr.

Armillaria mellea (Vahl.) Fr., mucida (Schrad.) Fr.

Tricholoma sejunctum (Sow.) Fr., albobrunneum (Pers.) Fr., rutilans (Schaeff.) Fr., terreum (Schaeff.) Fr., var. *chrysites Jungh., cuneifolium Fr.
Clitocybe clavipes (Pers.) Fr., fragrans (Sow.) Fr.
Laccaria laccata (Scop.) Berk., var. amethystina Bolt., var. tortilis Bolt.
Collybia radicata (Relhan) Fr., platyphylla Fr., fusipes (Bull.) Fr., maculata (A. & S.) Fr., butyracea (Bull.) Fr., cirrhata (Schum.) Fr., tuberosa (Bull.) Fr., dryophila (Bull.) Fr., *clusilis Fr.
Mycena *olivaceo-marginata Mass.†, pura Pers., *flavo-alba Fr., rugosa Fr., galericulata (Scop.) Pers., polygramma (Bull.), Pers., *parabolica (A. & S.) Fr., ammoniaca Fr., sanguinolenta (A. & S.), galopa Pers., leucogala Cke., epipterygia (Scop.) Pers., vulgaris Pers., *stylobates Pers.
Omphalia *striaepilea Fr., grisea Fr., fibula (Bull.) Fr., var. *Swartzii Fr.
Pleurotus septicus Fr.
Pluteus cervinus (Schaeff.) Fr. *hispidulus Fr.
Entoloma sericeum (Bull.) Fr., nidorosum Fr.
Clitopilus prunulus (Scop.) Fr.
Nolanea pascua (Pers.) Fr.
Claudopus variabilis (Pers.) Sm.
Pholiota terrigena Fr., radicosa (Bull.) Fr., spectabilis Fr., adiposa Fr., mutabilis (Schaeff.) Fr.
Inocybe *cervicolor (Pers.) Quél., carpta (Scop.) Fr., fastigiata (Schaeff.) Fr., rimosa (Bull.) Fr., geophylla (Sow.) Fr.
Hebeloma fastibile Fr.
Flammula carbonaria Fr., inopa Fr.
Naucoria melinoides Fr., *tabacina DC., *myosotis Fr., *escharoides Fr.
Pleuteolus *aleuriatus Fr.
Galera tenera (Schaeff.) Fr., *spartea Fr., hypnorum (Batsch) Fr.
Tubaria furfuracea (Pers.) Sm., *paludosa Fr., *inquilina Fr.
Crepidotus mollis (Schaeff.) Fr., applanatus (Pers.) Fr.
Agaricus *elvensis (B. & Br.) Massee, campestris (Linn.) Massee.
Stropharia aeruginosa (Curt.) Fr., albocyanea (Desm.) Fr., merdaria Fr., stercoraria Fr., semiglobata (Batsch) Fr.
Hypholoma sublateritium (Schaeff.) Fr., epixanthum Fr., fasciculare (Huds.) Fr., velutinum (Pers.) Fr., appendiculatum (Bull.) Fr., *hydrophilum (Bull.) Fr.
Psilocybe subericea Fr., uda (Pers.) Fr., semilanceata Fr.
Psathyra corrugis (Pers.) Fr., fibrillosa (Pers.) Fr.
Anellaria separata (Linn.) Karst.

† On Mr. Lister's lawn at Leytonstone, 6th October, 1906.

Panaeolus sphinctrinus Fr., campanulatus (Linn.) Fr., papilionaceus (Bull.) Fr.

Psathyrella *gracilis Fr., disseminata (Pers.) Fr., *atomata Fr.

Coprinus comatus Fr., atramentarius Fr., *fuscescens Fr., cinereus Schaeff., niveus Fr., micaceus (Bull.) Fr., radiatus (Bolt.) Fr., *ephemerus Fr., plicatilis (Curt.) Fr.

Bolbitius fragilis Fr.

Cortinarius (Phlegmacium) varius (Schaeff.) Fr., largus Fr., anfractus Fr., glaucopus (Schaeff) Fr., purpurascens Fr.

(Myxacium) collinitus Fr., elatior Fr., *vibratilis Fr.

(Inoloma) albo-violaceus (Pers.) Fr.

(Dermocybe) caninus Fr., anomalus Fr., sanguineus Fr. cinnamomeus (Linn.) Fr., lepidopus Cke.

(Telamonia) torvus Fr., armillatus Fr., hinnuleus, hemitrichus Fr., rigidus Fr., paleaceus Fr.

(Hydrocybe) *leucopus (Bull.) Fr., decipiens (Pers.) Fr., *acutus (Pers.) Fr.

Paxillus involutus (Batsch) Fr.

Hygrophorus laetus Fr. conicus (Scop.) Fr.

Lactarius turpis (Weinm.) Fr., blennius Fr., vellereus Fr., quietus Fr., *theiogalus (Bull.) Fr., rufus (Scop.) Fr., glyciosmus Fr., serifluus (DC.) Fr., mitissimus Fr., subdulcis (Bull.) Fr.

Russula adusta Pers., *mustelina Fr., *olivascens Fr., furcata Pers., rosacea Fr., depallens Fr., virescens (Schaeff.) Fr., lepida Fr., rubra DC., vesca Fr., azurea Bres, cyanoxantha (Schaeff.) Fr. consobrina Fr., var. sororia Larb., foetens Pers., fellea Fr., emetica Fr., ochroleuca Fr. fragilis Pers., var. *nivea Cke., var. *violacea Quél., var. fallax Cke., *puellaris Fr., alutacea Fr., armeniaca Cke. lutea (Huds.) Fr.

Cantharellus cibarius Fr., aurantiacus Fr., tubaeformis Fr.

Marasmius peronatus (Bolt.) Fr., oreades (Bolt.) Fr., erythropus Fr., *archyropus (Pers.) Fr., ramealis (Bull.) Fr., androsaceus (Linn.) Fr., epiphyllus Fr.

Lentinus cochleatus (Pers.) Fr.

Panus stipticus (Bull.) Fr.

Lenzites betulina (Linn.) Fr.

Boletus *luteus Linn., elegans (Schum.) Fr., badius Linn., piperatus Bull., *variegatus Swartz, chrysenteron Fr., subtomentosus Linn., edulis Bull., luridus Schaeff., duriusculus Schulz., versipellis Fr., scaber Fr.

Fistulina hepatica (Huds.) Fr.

Polyporus rufescens Fr., squamosus (Huds.) Fr., giganteus Fr., sulphureus Fr., hispidus Fr., cuticularis Fr., *rutilans Fr., betulinus (Bull.) Fr., *fumosus Fr., adustus Fr., lacteus Fr., fragilis Fr.

Polystictus perennis Fr., versicolor (Huds.) Fr.
Fomes igniarius (Huds.) Fr., annosus Fr., *applanatus (Wallr.) Fr.
Poria vaporaria Fr., *mollusca Fr., *vulgaris Fr., *medulla-panis Pers., *obducens Pers.
Trametes gibbosa Fr.
Daedalea unicolor (Bull.) Fr.
Merulius tremellosus Schrad.
Hydnum repandum Linn., *alutaceum Fr., *niveum Pers.
Irpex *spathulatus (Schrad.) Fr., *obliquus Fr.
Phlebia radiata Fr.
Grandinia granulosa Fr.
Craterellus cornucopioides Pers.
Stereum hirsutum Fr., purpureum Pers., rugosum Fr.
Corticium laeve Pers., *calceum Fr.
Peniophora quercinum (Fr.) Cke.
Hypochnus *violeus Quél.
Thelephora laciniata Pers.
Coniophora *arida Fr., umbrinum (A. & S.) Fr., puteana (Schum.) Fr.
Clavaria cristata Holmsk., rugosa Bull.
Pistillaria quisquiliaris Fr.
Exidia albida (Huds.) Bref.
Tremella frondosa Fr., *lutescens Pers., *indecorata Smrft.
Dacryomyces deliquescens Duby, stillatus Nees.
Calocera viscosa Fr., cornea Fr.
Cyathus striatus Hoff.
Sphaerobolus stellatus Tode.
Lycoperdon pyriforme Schaeff., perlatum Pers., umbrinum Pers., depressum Bon.
Bovista plumbea Pers.
Scleroderma vulgare Fr.
Ithyphallus impudicus (Linn.) Fisch.
Puccinia hydrocotyles (Link) Plow.
Sphacelotheca hydropiperis (Schum.) De Bary.
Pilobolus crystallinus Tode.
Sporodinia grandis Link.
Piptocephalis Freseniana De Bary.
Gymnoascus Reesii Baran.
Nectria peziza (Tode) Fr.
Hypomyces aurantius (Pers.) Tul.
Hypocrea rufa (Pers.) Fr.
Claviceps microcephala (Wallr.) Wint.
Sordaria fimicola (Rob.) Cés & de Not.
Podospora minuta (Fckl.) Wint.
Melanomma pulvis-pyrius (Pers.) Fckl.
Diatrype stigma (Hoffm.) de Not.

Hypoxylon multiforme Fr., fuscum (Pers.) Fr., coccineum Bull.
Ustulina vulgaris Tul.
Xylaria hypoxylon (Linn.) Grev.
Trochila ilicis (Fr.) Crouan.
Patellaria macrospora Phil.
Cenangium populneum Rehm.
Scleroderris fagi (Phil.) Mass.
Coryne sarcoides Tul.
Ascobolus furfuraceus Pers.
Ascophanus carneus Boud.
Mollisia cinerea (Batsch) Karst.
Helotium citrinum Fr.
Dasyscypha virginea (Batsch) Fckl., ciliaris (Schrad.) Sacc., hyalina (Pers.) Mass.
Humaria granulata (Bull.) Sacc.
Otidea aurantia (Pers.) Mass.
Sphaeronemella fimicola March.
Oedocephalum laeticolor B. & Br.
Penicillium glaucum Link.
Verticillium lateritium Berk.
Acrostalagmus galeoides A. L. Sm. n. sp.
Didymocladium ternatum Ba. (second record for Britain)
Trichothecium roseum Link.
Bispora monilioides Cda.
Cladosporium epiphyllum Mart., herbarum Link.
Stilbum erythrocephalum Ditm.
Stysanus stemonitis Cda.
Tubercularia vulgaris Tode.

Mycetozoa.

Badhamia panicea Rost., utricularis Berk. (In plasmodium condition on *Armillaria mucida*).
Physarum nutans Pers., leucopus Link. High Beach (First record for Epping Forest)
Fuligo septica Gmel.
Stemonitis fusca Roth., ferruginea Ehr., flavogenita Jahn.
Comatricha obtusata Preuss, typhoides *a* Rost.
Enerthenema elegans Bowm.
Dictydiaethalium plumbeum Rost.
Trichia varia Pers.
Arcyria albida Pers., punicea Pers.
Lycogala miniatum Pers.

PRESIDENTIAL ADDRESS.

By Arthur Lister, F.R.S., &c.

The British Mycological Society was founded at a meeting of the Mycological section of the Yorkshire Naturalists' Union at Selby, on the 19th September, 1896. After the death of Dr. Bull, the Woolhope Naturalists' Club ceased to be the resort of the leading Mycologists and the annual fungus forays had been abandoned. Hence it was suggested that the present Society should be formed to hold yearly meetings of a week's duration at different centres throughout the country, with the object of obtaining a more complete knowledge of the fungus flora of Britain and to give the opportunity of careful study of the specimens collected.

Under the fostering care and valuable assistance of our Secretary, Mr. Carleton Rea, the Society has had a prosperous experience which has amply justified its foundation; the list of its members has steadily increased and includes many distinguished names. Prof. Marshall Ward was at one time President, and it is with deep regret that we lately heard of his death; as a man of high scientific attainments and as a personal friend, we mourn his loss.

The Society has met successively at Sherwood Forest, Dublin, the New Forest, Rothiemurchus Forest, Exeter, Hereford, Savernake Forest, Whitby and Haslemere. I have had the privilege of taking part in the forays at Savernake and Haslemere, the latter centre including the rich forest of Woolmer, and thanks to the arrangements of our Secretary we obtained permission to explore woods not open to the public.

In coming to Epping Forest you may not find the abundance of material that Savernake and Woolmer afforded but in their annual fungus foray the Essex Field Club has for many years made fine collections, and has added many species new to the British flora. As a member of that Club I may express the great satisfaction we have in welcoming the British Mycological Society in their visit to our county. At the same time I may say, as a member of that Society that it gives us great pleasure that members of the Essex Field Club are joining our meeting; I would especially thank Mr. Cole for his valuable and experienced help. One feature of our time at Haslemere which was

of great interest was the day spent in Woolmer Forest. White, in his history of Selbourne speaks of the Royal Forest of Woolmer as a tract of land about seven miles in length by two and a half in breadth. He says "it consists entirely of sand covered with heath and fern, without having one standing tree in the whole extent." Now it is largely clothed with fine timber, planted by Government during the last century. White gives a delightful account of the red deer that once inhabited that Royal chase and of Queen Ann on her journey to Portsmouth watching the herd of about 500 head driven round for her inspection, and tells how later, in about 1740, the yeoman prickers were sent down to capture them all and convey them in carts to Windsor. In Epping Forest we have the remains of the vast forests that formerly covered a large part of Essex, and there is every reason to believe that it has never been under cultivation, but that the trees that established themselves in the earliest days have continued in unbroken succession to the present time.

The red deer that once abounded have now disappeared. The last of which we have any record was hunted from Hainault Forest in the year 1829, and was secured in my father's grounds at Upton. The horns were sawn off and presented to the mistress of the house and the deer was carted off to Windsor. Bell, who published his history of British Quadrupeds eight years later, in 1837, says:—"It is within the recollection of some of my friends that a few red deer still existed in Epping Forest, but they have now been extinct there for many years," so that this was probably the last survivor of the original stock. I have the horns, and value them as a relic of old Essex Natural History

James 1st introduced the hardy dark variety of fallow deer from his Scotch chases, and the deer we see in our rambles are the descendants of that stock. Roe deer were brought by Mr. Buxton from Dorsetshire a few years ago and are now well established.

Hainault Forest was a Royal chase but was disforested in 1851; now, thanks to the exertions of Mr. Buxton, a large part has been restored and public interest secured; it is being re-planted and will soon revert to being a home of wild animals.

Queen Elizabeth's Lodge, now the Forest Museum, tells of the days when that monarch, following the custom of her predecessors, hunted here.

The name of another ancient British Queen is associated with this part of the forest, for tradition tells of Boadicea having held Ambresbury Banks, or "Boadicea's Camp" as it is called, in her fierce struggle with the Romans about the time of Nero.

What remains of the earthworks show that it must have been a fortification of considerable strength.

The flora of the forest is not rich, owing to the poverty of the gravel soil; the hornbeam which forms so large a part of the timber is no doubt indigenous. You will have observed how they are all pollarded trees. Before the forest came under the protection of the Corporation of London, there were yearly forest sales by auction of "the lop and top"; the young wood was cut down over large areas every 10 years or so, and sold as faggots, poles, or peasticks, and for a long time after this cutting the shorn trunks presented a dismal appearance. They were crowded together to induce the young branches to grow up straight and close, and consequently become more marketable. When the verderers took them in hand and the "lop and top" was stopped, hundreds of the old hornbeams were thinned out, and a foolish cry was raised at the time that the forest was being destroyed; but it was a wise and necessary work, and every year the beauty of the forest is increased as the trees left have had room to grow, and it probably never presented such charming woodland scenery as it does at the present day.

Turning now to the real business of our Society, we are much indebted to those of our members who have worked hard in the field, both here and on the Continent in studying the varied aspects that many species of fungi present, and in taking in hand the difficult work of suppressing unnecessary names. I cannot but think that much remains to be done in this direction; the puzzling variation in appearance caused by differences of temperature and by the influence of wet or dry seasons in these fleeting growths make great knowledge and judgment requisite in defining the limits of species with accuracy.

It is however in the microscopic investigation of fungi that such invaluable work has been done of late years, especially in its bearing on agriculture. I need not go further than refer to the extremely interesting presidential address of Mr. Biffin, to which we listened at Haslemere, in which he described the methods pursued for combating the parasitic fungi in cereals. This is practical work which may lead to results of incalculable value.

I cannot pretend to bring before you anything of such interest; indeed the only reason for my being placed in the honorable position I now hold was that I had done something in the study of Mycetozoa, Myxomycetes, Myxogastres, or slime moulds, as different writers have called them—a very doubtful qualification one might say, for Zoologists, contend that we should not include these organisms in the Vegetable Kingdom, but class them with the Protozoa. I am not prepared to dispute the point; they appear to stand in the border land between the

two Kingdoms, and in the meantime their literature is chiefly to be sought in botanical works and their study must always be associated with that of fungi.

I have brought a few drawings to illustrate the characters of some of the different genera and to show the wonderful contrivances for the dispersion of the spores which they possess. The group may be apportioned into two main divisions—first, those that have lime in the form of *calcium carbonate* in their structure, and second, those without lime. In those containing lime, it is either in minute rounded granules incorporated in the sporangium-walls and in pockets in the capillitium—the *Physaraceae*; or the lime is deposited in more or less stellate crystals on the outside of the sporangium-wall—the *Didymiaceae*. In this division the spores are dispersed by the action of rain and wind without any special contrivance for scattering them abroad. In those without lime we meet with various structures of great beauty. In *Stemonitis* the rigid stalk is continued up the centre of the cylindrical sporangium as a columella, from which branches are given off that divide at the surface into a net, so that when the delicate membrane covering the meshes shrivels up on drying, the spores are contained in an open-work basket, and through the apertures the minute spores are blown by the wind, so minute that a single sporangium such as that figured may contain three or four millions, and so light that they float in the air and can be borne over the face of the earth. In the genus *Arcyria*, during the short time that the sporangia take in developing from the creeping plasmodium to their perfect form, a capillitium is constructed consisting of a dense network of elastic threads. This expands to many times the volume of the unburst sporangium as soon as the delicate membranous wall shrivels in drying; and by this expansion the spores are scattered far and wide and borne away by the wind. In the genus *Trichia* the capillitium consists of numerous free threads lying among the spores; these threads are marked with thickened spiral bands extremely sensitive to moisture, so that if you breathe on them as you observe them under a lens they are seen to twist and writhe, lifting the spores, and again giving them to the winds. These are a few out of many of the striking features of the ripe fruits.

And now I wish to say a few words about their life. Speaking generally, the spores of fungi germinate by sprouting. A thread is produced which branches and forms the mycelium, which everyone knows so well in mushroom spawn, and "dry rot" or "blue mould." When the spore of a Mycetozoon is placed in water, the spore-wall, or egg shell, as we may call it, breaks, and the contents creep out as an independent amoeboid body—the swarm-cell. In a few minutes the

little creature assumes something of a pear shape, and from the narrow end a whip-like thread, the flagellum, is produced, at the base of which lies the nucleus. The flagellum is indeed, as Dr. Jahn has shown, a continuation of the nuclear substance. The swarm-cell now swims about with a jerking or dancing movement caused by the lashing of the flagellum, and searches for food. I well remember the astonishment with which I first saw a swarm-cell feed. I had by me a specimen of *Stemonitis*, whose spores hatched remarkably quickly, so that within an hour after placing them in water under a cover-slip scores of swarm-cells were dancing under one field of the microscope. It happened that I had on the table, a wine glass in which a woody fungus had been soaking for a week or more, and the water was turbid with hosts of bacteria. Out of curiosity I put a drop of the turbid water to the edge of the cover-slip. Immediately the bacteria spread with rapid movements among the swarm-cells, and then I observed that most of the swarm-cells had thrown out a brush of delicate pseudopodia from the thicker end, opposite to the flagellum, and to many of these pseudopodia struggling bacteria were attached; these were gradually drawn into the body substance, where a vacuole formed round them. I have often watched the process since, and seen several bacteria enclosed in a digestive vacuole, and during the course of an hour or so have observed them to be gradually dissolved and entirely assimilated. Swarm-cells may often be seen having two or three digestive vacuoles crammed with bacteria. I have watched two swarm-cells, that had seized a bacterium longer than their own breadth by the opposite ends, contending for 20 minutes which should gain possession, with fluctuating advantage until one gave way and the bacterium was swallowed up by the victor.

Besides the dancing motion, the swarm-cells creep in a linear form with the flagellum extended in front. I once watched one of these that came in its travels upon a group of bacteria on a glass plate; the vibrating tip of the flagellum appeared to detect their presence, for the swarm-cell stopped and spread itself as a disc over the cluster; in about a quarter of an hour it again crept forward with three of the bacteria stowed away in a digestive vacuole, and soon the swarm-cell gave a lash with its flagellum, released itself from the surface of the glass, and went dancing away among its swimming companions.

A day or two after the swarm-cells have hatched they begin to increase in number by bipartition; the flagellum is withdrawn, the swarm-cell takes a globular form, and the nucleus divides by karyokinesis. In the course of about a quarter of an hour the two halves of the nuclear plate separate and the globular swarm-cell becomes ellipsoid; then a constriction takes place, the cell divides, and each half resumes the form of the parent, and puts

out a lashing flagellum. An interesting article was published by Dr. Jahn in 1904, in which he shows that in some species of Mycetozoa the flagellum is produced before the separation of the daughter swarm-cells, and is seen to be a continuation of the achromatic fibres of the nuclear spindle; he considers the darkly staining point at the base of the flagellum is the centrosome. We have had the privilege of seeing his beautiful preparations.

It is uncertain how often the swarm-cells divide; the division can be followed for three or four times, and probably the number varies according to circumstances, but eventually the tendency to divide ceases, the flagellum is withdrawn, and the swarm-cells creep about in amœboid form. At this stage, when they meet in their wanderings they fuse together, though their nuclei remain distinct, and when a number have thus coalesced they appear to act as centres of attraction towards which others converge until the *plasmodium* with its rhythmic streaming of circulation is produced. The rapid flow, as we see it under the microscope is always an impressive object, the more so perhaps because it is so difficult to explain. In the creeping swarm-cell, the changing currents in the granular protoplasm are very similar to what we observe in an amœba, and the streaming of the plasmodium is a further development of that movement on a large scale. Under normal conditions the flow proceeds through the net-work of channels for a minute and a half, when it stops and immediately reverses its course, maintaining a rhythmic change backwards and forwards at nearly equal intervals of time but always rather longer in the direction in which the mass is advancing.

The plasmodium condition is the main stage in the life of the organism; the dividing of the swarm-cells at the beginning of the cycle and the formation of spores at its close occupy a very short time as compared with the prolonged existence of the plasmodium, which may last for weeks or months or perhaps years.

The plasmodium of nearly all the Mycetozoa appears to feed on decayed vegetable matter, either dead leaves or rotten wood. One species only, to my knowledge, devours living fungi; this is *Badhamia utricularis*; it preys principally on different species of *Stereum* and is abundant in our Forest when *Stereum hirsutum* is plentiful. This circumstance is favourable for its cultivation. It readily passes into the sclerotium or resting stage when deprived of moisture, in which state it can be preserved for several years without losing its vitality.

The photograph on the wall represents the plasmodium of this species which had been induced to creep over a thin coverslip; it was killed with absolute alcohol, stained with magenta, and mounted in Canada balsam. The dark turgid edge along the top shows where it was advancing, forced forward by the

flow that was pouring into it from the network of veins you see below—channels is a better word than veins, for there are no vein walls—the whole mass is in motion, but it is in these vein-like branching and constantly shifting channels that the main rhythmic streaming takes place.

A method for the preparation of pure sclerotium I have lately adopted may perhaps be worth mentioning. A portion of the sclerotium of *Badhamia utricularis*, soaked in water, is placed on a pileus of *Stereum* on a dinner plate under a bell-jar; it revives in the course of a few hours, and the plasmodium spreads over the fungus; as it grows we add fresh *Stereum* every morning and the exhausted pieces are cleared away. In the course of a fortnight or so the cultivation is thus led round the plate in a circle. When the plasmodium has increased sufficiently, the bell-jar is removed and the growth is left exposed for two days; then folded strips of wet blotting paper are laid with one end resting on the pile of *Stereum* and the other end lying on the clean part of the plate; these are covered by a plate of glass to prevent rapid evaporation, but the pile is left uncovered; the plasmodium, attracted by the moisture, leaves the *Stereum* and spreads over the wet blotting paper, on which it discharges its refuse matter. When it has spread sufficiently the plate of glass is removed and it is left to dry and form the clean sclerotium such as you see here. If a bit of the blotting paper one-eighth of an inch square thus coated with dry sclerotium is soaked in water and placed on a thin cover slip inverted over a moist chamber, such as a ring of four thicknesses of wet blotting paper on a glass slide, the plasmodium will revive in a few hours and the streaming can be watched under the microscope.

The causes that produce the change of the plasmodium into sporangia are not always easy to trace; want of nourishment is perhaps the principal one. If the plasmodium spreading over the wet blotting paper just described were allowed to remain moist, sporangia would form in four or five days, but if kept supplied with *Stereum* it would continue to grow for months. On the other hand *Didymium difforme* may go through the whole cycle from spore to sporangium in about a fortnight. When the change comes, the whole of the plasmodium participates in the formation of the fruit; a part is applied to the construction of the hypothallus and stalk, part to that of the sporangium-wall and capillitium, and the remainder is divided up into spores.

As already stated, at the time of the bipartition of the swarm cells the nuclei divide by karyokinesis; during the active life of the plasmodium, when of course they multiply enormously, a great number of observations with different species lead to the conclusion that they divide by constriction, or simple division.

Once, and once only, to my knowledge, has mitosis been observed in the streaming phase. This was in a preparation of *Badhamia utricularis* made by my son, J. J. Lister, F.R.S., a few days after the plasmodium had been revived from sclerotium. Here, every nucleus shows the spindle with the two halves of the equatorial plate just separated. It is an important and suggestive occurrence, and the question arises, how often does it take place, and what precedes or follows this exceptional process of division, if it be exceptional at this stage? After the capillitium has formed in the sporangium, all the nuclei divide by karyokinesis and each daughter nucleus becomes the centre of a spore.

There is something that appeals to the imagination in the thought that in a sporangium like that of the *Stemonitis* which we see drawn before us, after this delicate framework had been formed, there remained the spore material, containing, say, 2,000,000 nuclei. Then, simultaneously, each nucleus divided, so that there were 4,000,000 nuclei, and these, so nicely apportioned in number to the mass of the spore substance with which they had to deal, that in a few minutes it became divided up into 4,000,000 spores, all equal in size. An hour or two later and the spores were ripe, each enclosed by a spore-wall so minutely sculptured that the pattern can only be made out with our highest glasses, and yet that pattern is constant in this species all over the world.

I have dealt at perhaps tedious length with the microscopic aspect of the Mycetozoa, and of course without the microscope little knowledge can be gained of them; but they are beautiful objects even in the field, and to those who search for fungi with an eye a little trained to detect their minute forms, they are seen to abound in wet seasons among dead leaves and on old stumps. Then they have the advantage of being easily preserved; with moderate care to protect them from damp and insects they will last indefinitely, and remain as fit for microscopic examination as when first gathered. We have lately received them in perfect condition from Japan, Brazil, New Zealand, and from Ceylon where our friend Mr. Petch who used to join our Fungus Forays is making very valuable collections.

QUELQUES RECTIFICATIONS ET OBSERVATIONS CRITIQUES SUR LES "ILLUSTRATIONS OF BRITISH FUNGI" DE COOKE.

Par M. Em. Boudier.

Dans un ouvrage aussi important que les "*Illustrations of British Fungi*" de *Cooke*, il est impossible que sur la quantité d' espèces figurées il ne s'en trouve quelques unes qui soient représentées sous des noms qui ne sont pas exacts, ou dont l' exécution faissant à désirer, ne les rende peu reconnaissables. Il m'a semblé que quelques rectifications ou observations critiques pourraient avoir quelqu' utilité sans nuire en rien à la réputation de ce bel ouvrage consulté journellement par tous les mycologues. Cette note n'est d'ailleurs que le résultat de mes observations personnelles prises parmi celles qui m'ont le plus frappé, laissant de côté le plus grand nombre des espèces que je regarde comme bien nommées, ou sur lesquelles ne les ayant pas vues en nature je ne puis me prononcer. Voici donc ce que je crois pouvoir dire :

Pl. 1. *Amanita virosa* Fr. Forme robuste. Cette espèce est habituellement plus grêle.

2., ——— *phalloides* Fr. Je regarde cette planche comme représentant plutôt l' *Amanita mappa* var. *citrina* Schaeff. que *phalloides* qui est habituellement à chapeau olivâtre.

3. ——— *verna* Bull. Par son bulbe cette figure ne représente certainement pas *Am. verna* mais bien *A. mappa* var. blanche et sans verrues.

7. ——— *excelsa* Fr. Couleur trop verdâtre.

8. ——— *strobiliformis* Fr. Mais couleur anormale.

10. ——— *aspera* Fr. Var. à verrues blanchâtres.

34. ——— *magnifica* Fr. Cette planche cadre bien avec celle du *Flora Danica*. mais je les crois toutes deux être une aberration d'*Am. rubescens*.

11. ——— *megalodactyla* Berk. Cette figure ressemble beaucoup à une petite forme de *lenticularis*.

35. ——— *adnata* Smith. Ne parait pas differer de *junquillea* Quél. nom postérieur. C'est aussi à mon avis l'*Oronge sucrée* de Paulet nom au contraire antérieur.

27. *Lepiota hispida* Lasch. Cette planche me parait représenter une varieté de *L. clypeolaria*. *L. hispida* est autre et est représentée mieux sur la planche 1180.

15. ——— *Naucina* Fr. Me parait plutôt appartenir à *Psalliota cretacea*.

5. ——— *Cepæstipes* Sow. Les figures inférieures seulement, les supérieures représentant *L. lutea* With. ou *flos-sulfuris* Schn.

18. ——— *granulosa* Batsch. Les figures supérieures seulement les inférieures devant être rapportées à *carcharias*.

213. ——— *granulosa* var. *rufescens* B. & Br. Me parait représenter *L. sistrata* Fr.

33. *Armillaria aurantia* Schaeff. Doit être rapportée à *rufa* Alb. et Schw.

47. *Armillaria subcava* Sch. Doit être regardée comme *serena* Fr. ou *Brebissonii* Gill.

72. *Tricholoma equestre* Linn.! Mais variété.

54. ——— *portentosum* Fr. Ne représente pas cette espèce qui a un tout autre aspect sans que je puisse préciser laquelle.*

76. ——— *acerbum* Bull. Me parait bien cette espèce, mais la couleur est beaucoup trop rousse et trop foncée.†

58. ——— *flavo-brunneum* Fr. Par ses lamelles blanches et non jaunâtres, ces figures représentant plutôt *Trich. stans*.

60. ——— *imbricatum* Fr. Doit être rapporté plutôt à *vaccinum*.‡

50. ——— *terreum* Schaeff. Cette planche représente mal le tomentum du chapeau qui n'est jamais strié.

* This is generally taken for *Collybia platyphylla*, see vol. 1, p. 41.—C.R.

† This defect of colour was pointed out by Dr. M. C. Cooke himself, see Grevillea, vol. 19, p. 37.

‡ This was subsequently so corrected in Handbook of British Fungi, 2nd edition, p. 30, and Grevillea, vol. 19, p. 37.

166. ——— *cartilagineum* Bull. Ce n'est pas l'espèce type de Bulliard qui est représentée ici et qui est tout autre, mais celle de Fries qui rentre dans le groupe des *terreum.*

93. ——— *tumidum* Pers. Ces figures ressemblent plus à *Trich. portentosum* qu' à *tumidum.*

94. ——— *lascivum* Fr. Figures trop grêles. Je doute qu'elles appartiennent à cette espèce

229. ——— *albellum* Fr. Couleur trop jaune.

69. ——— *album* Fr. Couleur beaucoup trop jaune.

67. ——— *nudum* Bull.
133. ——— *nudum major.* } Ces deux planches représentant plutôt *Trich. personatum.*

99. ——— *humile* Fr. Les figures inférieures se rapportent plutôt à *Trich. sordidum.*

263. ——— *humile* var. *blandum* Berk. Est plutôt une variété pale de *melaleucum.*

200. *Clitocybe rivulosa* Fr. ! Mais mal représenté.

280. ——— *elixa* Sow. Planche représentant plutôt *Cl. inornata* du même auteur.

136. ——— *gilva* Pers. Non! mais forme d'*infundibuliformis*! *gilva* est beaucoup plus robuste, plus épais.

84. ——— *flaccida* Sow. Est plutôt *inversa.**

137. ——— *lobata* Sow. N'est qu'une forme d'*inversa.**

127. ——— *Sadleri* Berk. Est *Hypholoma fasciculare* resté stérile.

267. *Collybia acervata* Fr. C'est à mon avis plutôt *Marasmius erythropus.*

269. ——— *lacerata* Lasch. Me parait représenter plutôt un *Inocybe.*

241. *Omphalia pseudo-androsacea* Bull. Figures beaucoup trop blanches et ne représentant pas cette espèce qui est plus petite plus grise et à lames plus écartées.

227. *Pleurotus ulmarius* Fr. Figures un peu trop colorées.

195. ——— *ostreatus* Fr. Ce n'est pas cette espèce mais *Pl. sapidus* Kalchbr. Le pied n'étant pas hirsute.

* Dr. M. C. Cooke suggested they were all forms of one species, Grevillea, vol. 19, p. 37.—C.R.

196. ——— *ostreatus* var. *euosmus* Berk. Me parait encore être *Pl. sapidus.*

517. *Pluteus ephebius* Fr. Planche douteuse, le chapeau est trop pâle pour cette espèce.

518. ——— *semibulbosus* Fr. N'est pas cette espèce, le chapeau est trop blanc et trop largement cannelé.

598. ——— *roseo-albus* Fr. Cette planche par les spores rondes et échinulées doit représenter *Pleurotus subpalmatus.*

422. ——— *phlebophorus* Dittm. var. *reticulatus* Cke. N'est qu'une forme déjà figurée par Richon sous le nom d'*Entoloma Cookei*, de *Pleurotus subpalmatus* dont la pellicule gélatineuse du chapeau s'est contractée en alvéoles par dessication. Les spores sont les mêmes.

313. *Entoloma repandum* Bull. Est à mon avis un *Inocybe.*

581. ——— *liquescens* Cooke. N'est pas un *Entoloma* mais probablement un état jeune et très frais de *Psilocybe spadiceo-grisea.*

470. ——— *frumentaceum* Bull. Doit être placé dans les *Tricholoma* par ses spores non anguleuses.

319. ——— *clypeus* Fr. = *clypeatum* Fr.

377. *Nolanea mammosa* Fr. C'est bien cette espèce mais la couleur est trop pâle.

345. *Acetabularia acetabulosa* Sow. Cette planche reproduit assez bien le *Pluteus semibulbosus* et mieux que celle de Sowerby dont elle n'est cependant que la copie.

348. *Pholiota caperata* Pers. Mauvaises figures ne représentant pas cette espèce mais peut-être une variété d'*aurea.***

349. ——— *terrigena* Fr. Ces figures qui ne reproduisent pas la véritable *Phol. terrigena*, doivent être rapportées à *Flammula ochrochlora.*

362. ——— *pudica* Fr. Est plutôt *Phol. ægerita* recoltée par un temps sec.

363. ——— *leochroma* Cooke. Ne me semble qu'une forme d'*ægerita.*

** The original of this plate was named *aurea* by Phillips and was from Den of Airlie in Scotland, W.B.A.

364. ——— *capistrata* Cke. Est encore *Ph. ægerita* récoltée par temps humide.

453. ——— *ægerita* Fr. Même espèce mais forme robuste.

365. ——— *ægerita* Fr.! Mais variété.

370. ——— *tuberculosa* Schaeff. Me parait être *Phol. squarrosa* var. *verruculosa.*

354. ——— *Cookei* Fr. Est *Flammula ochrochlora* sans aucun doute!

356. ——— *unicolor* Fl. D. Me parait être *marginata* par ses lamelles étroites et sa station sur Mélèze.

503. ——— *mycenoides* Fr. Ces figures me paraissent devoir être rapportées plutôt à *togularis* qu'à *mycenoides.*

425. *Inocybe cincinnata* Fr. Ne peut être cette espèce par ses spores qui sont figurées verruqueuses.†

381. ——— *Bongardii* Fr. Ces figures diffèrent complètement de Bongardii figuré par Fries dans ses *Icones selectæ.*

395. ——— *echinata* Roth. Est bien l'espèce de Roth., mais c'est la vrai *Agaricus hæmatospermus* de Bull. nom antérieur, et c'est plutôt une Lépiote.

454. ——— *fibrosa* Sow. L'espèce de Fries est différente! Je crois l'espèce figurée par Sowerby et dont la couleur est certainement passée, identique à *In. incarnata* de Bresadola.

416. ——— *Hebeloma longicaudum* Fr. var. *radicatum* Cke. Me parait devoir être rapportée à *Flammula lenta.*

431. *Flammula gymnopodia* Fr. Ne peut être cette espèce, mais bien *Fl. sapinea.*

439. ——— *lenta* Fr. Est plutôt *Flammula gummosa.*

511. *Naucoria sobria* Fr. var. *dispersa* B. & Br. Est plutôt *pusiola.*

521. *Psalliota augusta* Fr. Je regarde cette planche comme reproduisant *Psalliota campestris* var. *villatica* De Brondeau.

535. *Stropharia coronilla* Bull. Est plutôt *melasperma* var. *lutescens* surtout la figure A.

† This is referred to *I. lanuginosa* Bull. by Bres. Fung. Tri., vol. 1, p. 101.—C.R.

543. *Hypholoma storea* Fr. var. *cæspitosa* Cke. Est *Stropharia cotonea* Quél.

566. ——— *lacrymabundum* Fr. Est identique à *Stroph. caput-Medusæ* Pl. 540 et non à *lacrymabundum* Bull.

571. *Psilocybe atro-rufa* Schaeff. Couleur trop violette et taille trop grande pour être cette espèce.

573. ——— *semilanceata* Fr. var. *cærulescens* Cke. Cette planche ne peut certainement pas représenter cette espèce même comme variété.

625. *Panœolus fimiputris* Fr. Doit être rapporté à *campanulatus* par son pied rougeâtre.

656. *Psathyrella prona* Fr. La fig. A doit être rapportée à *Ps. disseminata.*

704. *Cortinarius infractus* Fr. Couleur trop jaune et pas assez olivâtre.

705. ——— *anfractus* Fr. Est probablement *infractus.*

711. ——— *talus* Fr. Est plutôt une forme de *multiformis.*

735. ——— *prasinus* Fr. Les figures sont trop jaunes.

849. ——— *herpeticus* Fr. Doit être rapporté à une des formes de *Cort. glaucopus.*

728. ——— *cristallinus* Fr. Est probablement *causticus* par sa chair colorée.

738. ——— *collinitus* Fr. Est *mucosus* Bull. ou *collinitus* var. *mucosus* de Fries.

739. ——— *mucosus* Fr. Représente plutôt *C. arvinaceus.*

740. ——— *mucifluus* Fr. Est *collinitus* typique. La fig. que donne Sowerby sous ce nom est *elatior.*

758. ——— *Bulliardi* Fr. Nom exact, mais mauvaise figure.

749. ——— *cotoneus* Fr. C'est pour moi *sublanatus.*

770. ——— *violaceus* Fr. Non! C'est une forme de *purpurascens.*

764. ——— *penicillatus* Fr. Mauvaise figure par conséquent douteuse.

787. ——— *orellanus* Fr. N'est pas cette espèce et est *brunneo-fulvus* suivant Quélet. *Orellanus* est plus grêle et de coloration plus dorée.

852. ——— *bivelus* Fr. N'est certainement pas cette espèce mais très probablement *laniger*.

801. ——— *torvus* Fr. Est plutôt une forme d'*impennis*, tandis, que *Berkeleyi* représenté Pl. 706 et 707 serait le type de *torvus*.*

866. ——— *evernius* Fr. Me parait représenter la forme à pied violacé d'*elatior*.

808. ——— *subferrugineus* Fr. Est *C. caninus*.

859. ——— *unimodus* Britz. Ne différe pas d'*erythrinus*.

875. *Paxillus involutus* Fr. Coloration trop jaune.

929. ——— *leptopus* Fr. Figuré avec les lamelles beaucoup trop écartées.

876. ——— *atro-tomentosus* Fr. Couleur trop rouge.

878. ——— *panuoides* Fr. Couleur trop citrine.

931. *Hygrophorus nemoreus* Fr. Ne me parait pas être cette espèce mais peut-être une forme de *leporinus*.

981. *Lactarius exsuccus* Otto. N'est autre que *Russula delica*.

999. ——— *volemus* Fr. Figures de couleur trop jaune et pas assez briquetée.

1012. ——— *serifluus* DC. La coloration n'est pas assez brune.

1001. ——— *mitissimus* Fr. Figures trop jaunes.

1017. *Russula densifolia* Gillet. N'est que *R. adusta* jeune.

1037. ——— *sardonia* Fr., var. Non! ce doit être *ochroleuca*, *sardonia* étant rouge et n'ayant pas les lames jaunâtres.

1072. ——— *lepida* Fr. Représentation mauvaise comme couleur et prise sans doute sur des échantillons décolorés.

1073. ——— *lepida* Fr. var. Est plutôt *depallens*.

1087. ——— *rubra* Fr. var. *sapida*. Est *R. atro-purpurea*.

1075. ——— *vesca* Fr. Ne représente pas cette espèce mais plutôt *cyanoxantha*.

1074. ——— *xerampelina* Schaeff. Oui! mais la figure inférieure doit être rapportée à *fusca* Quél.

* Surely Massee is right in considering this species as defined by Quélet to be a true Phlegmacium. Fries' description is quite different.—C.R.

1044. ——— *heterophylla* Fr. Me paraît devoir être plutôt rapportée à *olivascens*.

1127. *Marasmius candidus* Fr. Cette espèce est peut être le *M. candidus* de Fries, mais l'espèce de Quélet est tout autre.

955. *Armillaria Jasonis* Cke. & Mass. N'est probablement que *Lep. amianthina* développée luxueusement sur un substratum très nourrissant.

HOW TO DISTINGUISH THE SPECIES OF BRITISH LYCOPERDA IN THE FIELD.

By Carleton Rea, B.C.L., M.A., &c.

Our member, the Rev. W. L. W. Eyre, has asked me to give the Society some notes on the genus LYCOPERDON which will enable the student to identify the British species in the field and it is with that object in view that I offer these imperfect observations. I do not think our English text books set out sufficiently and definitely the nature and character of the exoperidium in this genus, and as far as I am aware the illustrious Doctor Lucien Quélet was the first person to make this the basis of the sub-divisions of this genus in his work "Les champignons du Jura et des Vosges." Now to thoroughly appreciate the characters of the exoperidium it is necessary to gather the specimen in a fresh and nice growing condition and uninjured as to its external features, although it may be immature when sectioned and so would not disclose the nature of the gleba as to the colour of the spores in mass and capillitium, the presence or absence of a diaphragm between the fertile and sterile tissue, and the presence or absence of a well-defined columella. To elucidate these points it is always advisable if possible to secure a specimen of the same species in a riper and more mature condition and then if we have these two factors present we ought without much difficulty to be able to identify the species in the field.

If the exoperidium is *very slightly tomentose and becomes smooth* like a kid glove it is LYCOPERDON BOVISTA Linn.; if it is covered only with *mealy granules* it is LYCOPERDON PUSILLUM Batsch, or LYCOPERDON CEPAEFORME Bull.*; if it consists

* *Pusillum* has no sterile base, *Cepaeforme* has a sterile base of minute cells.

of a *very friable, white, floccose membrane* which breaks up into *evanescent, star-shaped rosettes and flakes and forms a false ring-like* appearance at the apex of the sterile basal stratum and *finally disappears almost completely* it is LYCOPERDON VELATUM Vitt; if it is covered with *very floccose, pyramidal or flattened warts surrounded by a mesh work of furrows* that give it a *tessellated appearance* it is LYCOPERDON CAELATUM Bull.

In the five following species the exoperidium is characterized by having the *spines separate at the base but drawn together more or less at the apex into a point.* If the exoperidium is covered with *spinulose warts which are united at the apex and intermixed with minute simple spines and furfuraceous granules* all of which *wear away with age* it is LYCOPERDON DEPRESSUM Bon.; if it is *bristling with very long, curved, crowded, rigid, light coloured spines** which are *surrounded at the base by a circle or tessellated group of brown warts* it is LYCOPERDON ECHINATUM Pers., if the spines are *shorter and of medium size* and the capillitium is *olive* it is LYCOPERDON HOYLEI Berk.; if it is *tomentose with floccose spines which fall away in flakes* it is LYCOPERDON EXCIPULIFORME Scop.; if it is covered with *short, rigid, fragile spines and granules which agglomerate together in circles which are larger at the centre, and are either mucronate or reduced to flat brown warts* it is LYCOPERDON SACCATUM Fr.

In the rest of the British species of Lycoperdon the *spines* of the exoperidium are *pointed, free from one another* and only *very rarely united at their apices.* If the exoperidium is covered by a series of *flattened soldered warts* it is LYCOPERDON GEMMATUM Fl. D.; if it is covered with a series of *long, straight, rigid, fragile, caducous spines* which are *surrounded at their bases by circles of short warts* it is LYCOPERDON PERLATUM Pers.; if it is covered more or less with *short, thin, crowded, fragile, pointed, caducous warts* which are *more pointed and acicular generally on the stem* it is LYCOPERDON PYRIFORME Schaeff., and if it presents a *tessellated and spotted appearance* it is the variety TESSELLATUM Pers.; if it is *bristling with thin, crowded, soft, rigid, fragile bistre spines* it is LYCOPERDON UMBRINUM Pers., and if it is covered with *slender, soft spines that wither away* it is LYCOPERDON ATROPURPUREUM Vitt.

If there are *cord-like rooting strands of mycelium* attached to the base of the specimen then we have either LYCOPERDON ECHINATUM, HOYLEI, CEPAEFORME or PYRIFORME to deal

* C. G. Lloyd in his work "The Genus Lycoperdon in Europe" at p. 208 says that "the cortex has long *black* spines." I have never gathered them in this condition. and should think that this colour must be due to some preservative that had been used,

with, but this last species is separated from all other British Lycoperdons by its *lignicolous habit* and usually *caespitose growth*, the others being *terricolous* and growing *singly* with the exception of LYCOPERDON PERLATUM which is often found growing in pairs. LYCOPERDON CAELATUM is often characterized by having *a long tapering root* but its *large size* separates it along with LYCOPERDON BOVISTA from the rest and among the smaller ones LYCOPERDON PUSILLUM is the only one where the attenuated base is continued as a *long, slender, tapering root.*

I have now dealt with the main external features and I will now consider the internal characters as presented by a section of a mature specimen cut in the field.

If we find that the gleba is a *homogeneous mass of spores and capillitium* it is if *large* and *smooth* on the outside LYCOPERDON BOVISTA*, if *small* and *mealy* LYCOPERDON PUSILLUM; but if it is *divided up into a cellular, sterile, basal stratum* which is *distinct from the spores and capillitium* and if moreover these two portions are *separated from each other by a well developed diaphragm* it is either LYCOPERDON CAELATUM or DEPRESSUM. The former, as I said previously, is of *large size* whilst the latter is of *small size* and the *threads of the capillitium* are *colourless.* The upper portion of the endoperidium in both these species falls away in pieces and leaves the spores and capillitium as it were in an open goblet and it is in this condition that we often meet with it. If there is *no diaphragm* between the fertile and the sterile portions of the gleba but *the sterile portion is continued into a columella* from which the spores and threads of the capillitium spring it is either LYCOPERDON PYRIFORME or PERLATUM, but these are easily separated by the external markings of the exoperidium.

If the *cells of the sterile basal portion are very minute* it is LYCOPERDON CEPAEFORME but if they are *large and whitish* it is LYCOPERDON COOKEI† which C. G. Lloyd identifies with LYCOPERDON SPADICEUM Pers.

If the *spores in mass* appear to be *purplish* in hue then it is either LYCOPERDON ECHINATUM, HOYLEI or ATROPURPUREUM, but to further elucidate the characters of the spores resort will have to be made to the microscope at home and I have already indicated the features by which they may be recognised in the field.

I must now say some concluding words about the microscopic characters of the spores because George Massee in his Fungus Flora, vol. i., has divided the species into those with rough spores and those with smooth spores, but I feel quite sure that

* Lycoperdon Bovista sometimes develops a slight sterile basal stratum.
† This is unknown to me.

most of our members who have carefully examined the British Lycoperda spores will agree with me in saying that none of them are perfectly smooth if submitted to a Zeiss J water immersion objective. It would therefore be much better to classify our British species under two sections only as proposed by C. Van Bambeke in his paper in the Bulletin de la Société Mycologique de France,* namely, the *Asterosporae* and *Subasterosporae.* Under the *Asterosporae* we should range the *large echinulate spored* LYCOPERDON ECHINATUM, HOYLEI, ATROPURPUREUM, VELATUM and SACCATUM, and the *Subasterosporae* would include the remainder with *generally smaller, olivaceous spores.*

In this brief review I have excluded some species of Massee enumerated thereunder as LYCOPERDA in his work as I consider the British BOVISTAE have distinct characters of their own in having *free, pointed threads of capillitium.* Nor can I agree with C. G. Lloyd's definition of Morgan's genus CALVATIA which he separates from LYCOPERDON on the ground that the *peridium breaks up in its upper portion and has pedicellate spores* in the former, whereas the latter is characterized by *opening by a definite mouth and non-pedicellate spores,* but if he is consistent then his *Pratense* section of Lycoperda ought to be transferred to the former genus, as I take it that his LYCOPERDON PRATENSE is identical with my LYCOPERDON DEPRESSUM Bon.,† but as he gives no authority for his names it is impossible to trace this. Equally his creation of BOVISTELLA for the *pedicellate spored species* of Lycoperdons will not hold water, as we have many of these in other species of Lycoperda, and for example I cite LYCOPERDON ATROPURPUREUM.

I should add that an *elongated cylindrical form of* LYCOPERDON PYRIFORME is known as the var. EXCIPULIFORME (Desm.) and that a *smaller, club-shaped, yellower* form of EXCIPULIFORME is the variety FLAVESCENS of Quélet.

In the external characters I omitted to mention that LYCOPERDON PERLATUM is *umbonate* and PYRIFORME *rather umbonate.*

LYCOPERDON EXCIPULIFORME has the threads of the capillitium *sparingly or not at all branched* and COOKEI has them also *unbranched.*

* See vol. xxii. p.p. 27 and 28.

† By the laws of priority this plant should be known as *L. hyemale* (Bull.) Vitt. Hollós Gastero. Ung., p. 170.

A NOTE ON TRAMETES RUBESCENS.

By W. B. Allen.

With Plate 16.

In August and September, 1906, there occurred on *Salix caprea* at Willey, Shropshire, a Trametes which is perhaps worthy of a note.

On the first occasion that it was noticed the specimens were immature, being roundish irregular masses oozing out of the wood. The pilei varied from whitish to olive-brown in colour and were characterized by a dense pulverulence so that, when touched, every finger-mark remained imprinted.

On later inspection the fungus became dimidiate with a very decurrent base, the pileus beçame zoned and the pores were seen to be white and the orifices roundish becoming elongated and daedaliform in age, especially towards the margin.

The striking feature about the fungus, which could not fail to immediately arrest attention, was that the pores and flesh at once changed, on being scratched, from white to a beautiful crimson-lake colour, in some specimens almost to blood-red. On being dried, the whole hymenium naturally changed to a pinky-tan.

In our English handbooks there appeared to be nothing at all near to it except *Trametes Bulliardi*, which is a fungus we have often gathered, but never saw it change to crimson on being wounded: further *Bulliardi* is a sweet-scented species, whereas this was entirely odourless. On referring to Fries' Hymenomycetes Europaei we found that he mentioned a *Trametes rubescens* which seemed to fit most admirably, the chief points in the description being "ubique rubescens, junior albo pruinosa."

This species is not in our British Flora, moreover Fries had not seen it growing, and adds a note that it seems to be close to *Bulliardi*. In his description of this latter he says "poris e pallido, rufescentibus." This phrasing would seem to imply that the colour-change is a gradual process in course of age and in drying and is not the usual formula he employs when describing a fungus that changes instantly on being wounded.

Now *rufescens* is one of the words not fully dealt with by either Canon du Port or Mr. Wharton in their excellent papers on colours of fungi as used by Fries, but we can scarcely recon-

cile such a coarse word with the lovely tint of this Trametes. *Rufescens* is a word not freely used in describing fungi: it does not form the specific name of a single British Agaric. Fries applies it to the pileus and stem of *Lactarius subdulcis*, the pileus of *L. circellatus*, the gills in age of *Hygrophorus ovinus* and the stem and gills of *Lactarius rufus*, but not to the pileus which he calls *badio-rufus*.

Rufescens really means becoming *rufus*, which is a yellowish-red, whereas *rubescens* is suggestive of blushing, as seen in *Amanita rubescens* and *Rhizopogon rubescens*.

Fries applies this latter word to the interior of the stem of *Inocybe pyriodora*, and he says of that peculiar-smelling fungus *Entoloma ameides* "totus fungus rubescit."

But it is doubtful whether in using these words he had any such fine colour-distinction in his mind as some people have tried to make out. In describing *Polyporus rufescens* he says it is *carneus*, and of *Boletus rubescens* "pileo rufescente, stipite carneque rufescentibus," whilst under the two species we are considering he adds a note that *T. rubescens* and *T. Bulliardi* are apparently close to each other, as each verges into "fulvum vel rufum." Now these are distinct colours again, *fulvus* being the tawny of a lion and *rufus* is the word he uses for the zone on the stem of *Cortinarius haematochelis*.

Dr. Quélet instals *Trametes rubescens* as the standard species with a most excellent description, his "incarnat rosé" exactly meeting the case, and it is clear that he has this fungus in his mind, but he includes *Bulliardi* as a synonym, which is disconcerting, and refers them both to a form of *Lenzites tricolor*. Perhaps this is a case of wrongly lumping as he certainly was guilty in the matter of *Pholiota aurea* and *Ph. spectabilis*.

We cannot but think that this fungus is a much sounder species than many that have found a place in our Flora, presenting as marked a colour-change on being wounded as *Boletus luridus*, *Inocybe Godeyi* or *Agaricus haemorrhoidarius*, and that if it is really *Trametes Bulliardi* then the description of this latter as given in our books is totally inadequate and must have been drawn up from dried specimens, as it entirely fails to convey the slightest idea to the novice of the marked characteristics of this fungus in the fresh condition.

On one previous occasion at least this *Trametes* would seem to have excited curiosity—it may also have been a Shropshire specimen—it was in 1881 that the late Wm. Phillips, of Shrewsbury, sent a fungus to the Rev. M. J. Berkeley, and we have Mr. Berkeley's reply to Mr. Phillips, in which he says "Your fungus is undoubtedly *T. rubescens*, but I have always considered it the same with *Daedalea confragosa*. Fries' description does not accord with Bulliard's figure or description. I found it once

abundantly at Apethorpe on willow. It is a rare species, Fries had seen dried specimens only."

So Mr. Berkeley adds to our difficulties yet another species. This *Daedalea confragosa* is a common species in Shropshire occurring on decaying Rowan-trees, &c., and seems sufficiently distinct from the two we are now considering.

It is a peculiarity of this Trametes that it will not cast spores. We have failed to obtain any casting from at least a dozen specimens, and Mr. Carleton Rea, to whom specimens were submitted, met with the same result. The few isolated spores that were met with appeared to be curved in shape, but it would not be safe to give any measurement from these.

NOTES ON BRITISH CLAVARIAE.

By A. D. Cotton, F.L.S., The Herbarium, Royal Botanic Gardens, Kew.

The following notes deal with the nomenclature of two species of *Clavaria*, viz., *C. inaequalis*, Müller, and *C. fistulosa*, Holmsk.

Before considering these it may however be mentioned that during the course of an investigation of this genus, special attention has been paid to the spore and its value as a diagnostic character. The result of such a study shows that many species are remarkably constant in the size and form of their spores, whilst others are characteristically variable. Further, that the recognition of the type of spore of a given species will, in some cases, be found useless as a character to separate the plant from other species externally similar, whereas in other cases it will be found of great service for this purpose.

Additional work is required, but it is clear that a more accurate knowledge of the spores of the Clavariae would be of value, especially to the systematist.

Clavaria inaequalis, Müller (in Flora Danica).

In the opinion of the writer *C. dissipabilis*, Britz. must be regarded as a synonym of *C. inaequalis*.

Practically the only feature which has hitherto kept the two apart is the character of the spores, those of the former were stated to be subglobose and provided with spines, and those of the latter elliptical and smooth. That *C. inaequalis* possesses smooth elliptical spores is a statement however which cannot be supported by facts. There is no type specimen in existence, but the ideas of older writers as to the plant are unmistakable.

It seems therefore desirable that the question should be settled and the evidence brought to light.

The history of the two names may be given as follows, taking first that of:—

C. DISSIPABILIS. This was described by Britzelmayr in 1885 (Hymenomyceten aus Südbayern, p. 289, fig. 28). The spores are stated to be 4-6μ diam. and provided with spines of different lengths. The coloured figure given is not elaborate but it shows the habit of the plant.

In 1893 Massee (Grevillea xxii., p. 42) recorded *C. dissipabilis* for Britain from Yorkshire specimens sent by C. Crossland; since then it has been found commonly throughout the country. Together, however, with the appearance of *C. dissipabilis*, the smooth spored *C. inaequalis* ceased to be met with, and those plants which would have previously been named *C. inaequalis* were found on examination to be rough spored and hence referred to Britzelmayr's species.

C. INAEQUALIS. The original reference and figure is in Flora Danica 1780, tab. 836, fig. 1. A yellow or orange-yellow fungus is figured. The clubs, which are somewhat flattened and pointed, grow in groups of threes and fours. It is named "*Clavaria* inaequalis *caespitosa compressa, lutea, apice acuminata.*" Our ideas of *C. inaequalis* originate from this figure; there is no "type" specimen. In 1797 when Persoon brought together the different species of Clavaria, he included *C. inaequalis*, quoting Fl. Dan. and giving a diagnosis. From Persoon's time and onward *C. inaequalis* has been recognised and recorded as of frequent occurrence. The first reference to the character of the spores appears to be in 1882, in which year Karsten (Ryss. Finl. Skand. Hattsv. ii., p. 171) describes these bodies as elliptical, $10 \times 5\mu$. This statement has been accepted by later writers; consequently when a rough spored plant was found it was pronounced new.* Thus Britzelmayr formed his *C. dissipabilis* and Boudier and Patouillard founded their *C. similis* (now a generally admitted synonym of *C. dissipabilis*) stating that it had been previously confounded with *C. inaequalis* but differed chiefly in the character of the spores.

When, however, we come to examine specimens in Herbaria, a *C. inaequalis* with elliptical smooth spores can nowhere be found. In Berkeley's Herbarium at Kew, for instance, all the European specimens of *C. inaequalis* (it is unnecessary to consider those outside Europe) fall into *C. dissipabilis*, with the

* It is interesting to note that Saccardo gives an alternative type of spore for *C. inaequalis*, "elliptical $10\text{-}12 \times 5\frac{1}{2}\ \mu$" or "irregularly globose 8 μ." Unfortunately the former measurement has been usually accepted, whereas the latter is approximately correct. Quélet also in 1888 gives the spores as globose 7 μ, but does not mention spines.

exception of a few odd plants, which are obviously small tufts of *C. fusiformis*. There can be no doubt therefore that Berkeley's idea of *C. inaequalis* was the rough spored plant. Other specimens of the species in question in the Herbaria of Currey, Broom, Bloxam (in British Museum) and Cooke (at Kew), together with various Continental exsiccati prove to be rough spored. Not a single plant is to be found in the Kew or British Museum collections, which can be called *C. inaequalis*, with smooth elliptical spores $10 \times 5\mu$, nor has such a plant been observed in the material sent to the writer by correspondents during the past three or four years; all on the other hand are rough spored.* Finally, Karsten's own exsiccati, No. 439, referred to by him in the passage above quoted, does not show the character of spore he described, but on the contrary those of the globose roughened type.

It seems therefore certain, that the statement, spores elliptical $10 \times 5\mu$ was incorrect, and that the description of *C. dissipabilis* as a new species was the result of this erroneous impression.†

C. inaequalis Müller must therefore be described as a species possessing sharply warted or spiney, irregularly globose spores, 5-6μ diam. (excl. spines) and including *C. dissipabilis* Britz. and *C. similis* Boud. and Pat. as synonyms.

Clavaria fistulosa Holmsk.

For the benefit of members of the Society, notes may be here added drawing attention to observations on this species by F. von. Höhnel. His results are published in the Oesterreische Botanische Zeitschrift 1904, p. 425-427.

C. fistulosa, was described by Persoon in 1797 (Comm. de Fungi Clavaeformibus, p. 34), though the name had been previously employed by Holmskiold (Annalen der Botanik, xvii., 1796, p. 64; see also, Beata ruris otia 1799? vol. i., p. 15 with fig.).

In 1799 Sowerby described *C. Ardenia* in "English Fungi," tab. 215. There is no doubt that this is a synonym of *C. fistulosa*, as Schroeter, Quélet and others have assumed. Massee is also of the same opinion, and it was by an oversight that in 1892 he kept them apart (Brit. Fung. Flora, vol. i., p. 86 and 87).

Von Höhnel now adds *C. contorta* Holmsk as a further synonym. This plant, of which little has been hitherto known,

* A small plant with spores $7 \times 3\ \mu$ has been met with which is generally labelled in Herbaria *C. helvola*, Pers. Some writers have taken this plant for *C. inaequalis*, it cannot however for one moment be regarded as the *C. inaequalis* of Flora Danica.

† The spores of *C. argillacea* Fr. correspond to the measurement $10 \times 5\mu$. As this species has not infrequently been mistaken for *C. inaequalis*, we have here a possible explanation of the origin of the error.

he regards as a distorted and abnormal form of *C. fistulosa*. His reasons for so doing are:—(1) The measurements of the spores, 14-20 × 7-8μ, thus showing the same variation in length as in *C. fistulosa*; (2) the presence of latex tubes as in that plant; and (3), the growth of normal *C. fistulosa* from plants of *C. contorta*.

There seems to be no reason for assuming that Von Höhnel's "ganz typische" *C. contorta* was other than the genuine plant, nor for regarding his conclusions as other than correct. *C. Ardenia* and *C. contorta* would therefore be reduced as synonyms of *C. fistulosa*.

OZONIUM AURICOMUM LINK.

By Carleton Rea, B.C.L., M.A., &c.

In the British Mycological Transactions for the season 1901, vol. i., p. 181, Dr. C. B. Plowright favoured us with a paper in which he traced a connection between the occurrence of *Ozonium auricomum* Link growing round a flower pot containing a plant of Aspidistra and a growth of *Coprinus domesticus* Fr. which subsequently attracted his attention to the matter. Dr. Lucien Quélet in his Flore Mycologique de la France, published in 1888, at p. 48 makes both *Ozonium radians* Pers. and *auricomum* Link to be the mycelial condition of *Coprinus radians* (Desm.) Fr. In the autumn of last year my friend Mr. W. B. Allen sent me on some *Ozonium auricomum* for identification, and in my reply I requested him to look out and see if he could not find a *Coprinus* growing along with it. A few days afterwards he met me at Wyre Forest and he then brought some of the *Ozonium auricomum* covered with a mass of *Coprinus radians* (Desm.) Fr. So it seems clear that two different species of Coprini arise from these *Ozonium*-like bodies. Since writing the above note Mr. D. A. Boyd informed me that he had connected the *Ozonium* with *Coprinus micaceus* Bull., and our President (Mr. Arthur Lister) at the Epping Foray said that he had found it associated with *Coprinus similis* B. & Br., and *C. micaceus* in a vast growth on a thick log in front of his house at Leytonstone, but it was not nearly in such abundance as the brown velvet felt that preceded the growth of *C. similis*.

FUNGI NEW TO BRITAIN.

By Annie Lorrain Smith, F.L.S., and Carleton Rea, B.C.L., M.A., &c.

With Plates 14, 15 & 16.

Urophlyctis Alfalfae P. Magn. Ber. Deutsch. Bot. Ges. xx. (1902), p. 291, pl. xv.

Magnus has published a long account of the occurrence of this fungus, but without definite measurements. The resting spores are globose with a flattened side in which are several pores. They are contained in hollow chambers formed by the cells of the host plant.

On roots of Lucerne, Herne Bay. E. S. Salmon.
Gard. Chron. XXXIX. 1906, p. 122.

Oospora lateritia Sacc. Malpighia XII., 1898, p. 218, pl. VIII., f. 15

Tufts cushion-like, scattered, sealing-wax red, 1-2mm. in diameter. Sterile hyphae creeping, septate, branched, 3-4μ thick, beset with small lateral outgrowths which bear the chains of conidia; Conidia globose cuboid, 4 × 3-4μ, dull reddish.

On decaying leaves, Luton. Mr. Saunders. March, 1906.

Oospora sulphurella Sacc. and Roum. Syll. IV. 21 (1886).

Tufts effused, velvety, light yellow; sterile hyphae creeping, fertile hyphae short, upright; conidia in chains, elliptical, 3-4 × 2μ.

On decaying bark. (Ardennes, Italy, Vienna.)

On Holly, Benthall, W. B. Allen, April 1906, and on Prunus spinosa near Perth, Mr. J. Menzies, February, 1907.

Acrostalagmus galeoides A. L. Sm. sp. n.

Tufts small, loose, white; vegetative hyphae branched septate; fertile hyphae erect, slender, the upper part with numerous branches arranged in whorls on the main stalk, branches 5 to 8 or more in a whorl, slender, 10-2μ in length, about 2-3μ wide at the base, tapering upwards and ending in a slight swelling, on which the spores are borne; spores numerous, forming a head, easily falling off, cylindrical, 4-6 × 1μ, colourless.

Collected at Epping Forest Foray by Mr. Hughes, on a decaying bracken.

Coniothyrium ribicolum P. Brun. Act. Soc. Linn. Bordeaux 1898, p. 14.

Perithecia globose, subglobose or globose-conical, black; spores subglobose or subovoid, sooty-brown, simple, rarely 1-2 guttulate, 3-4 × 2μ.

On dead branches of *Ribes nigrum*.

The specimens collected by Mr. Rea on the 7th of June, 1906, in the garden of The Manor House Farm, Sheriff's Lench, Worcestershire, were growing on the twigs of *Ribes Grossularia* and causing very great damage to the trees. The perithecia were developed below the epidermis, they are subglobose, more broad than deep, measuring about 140 × 80μ. The spores are rather elliptical, broad at the ends, 4-6 × 2μ. The differences from the type are too slight to justify the making of a new species.

Cudonia confusa Bres. Fung. Trid. vol. II., p. 67, pl. 179 and see pl. 15 hereof.

Pileus fleshy, convex, often depressed at the centre, rugulose, margin involute, viscid, soon dry, at first *pale cinnamon, then reddish brown or rufous*, 7-12 mm. broad, covered with distant, radiating folds underneath. Stem stuffed then hollow, *pulverulent*, round, at length compressed towards the base, of the same colour as the pileus but becoming fuscous at the base with age, 2-3 cm. long, 1-2 mm. thick. Asci spindle or club-shaped, stalked 110-120 × 11-12μ. Paraphyses thread-shaped, curved at the apex, 120-130 × 2μ. Ascospores crowded together, needle shaped, hyaline, multiguttulate, at length pseudo-septate, 30-35 × 2-2·5μ.

In a broken circle under beeches near Tsuga Canadensis, The Hermitage, Dunkeld, Perthshire, 25th September, 1906, Mr. C. McIntosh.

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Scleroderris bacillifera (Karst.) Sacc.* Syll. Disc. p. 595, n. 2461. Tympanis bacillifera Karst. Symb. Myc. p. 253. Phragmospora bacillifera Mass. Rabh. Krypt. Flo. Disc. p. 340, and see pl. 15 hereof.

Ascophores erumpent, sessile or subsessile, solitary or often 2-5 springing up together, glabrous, black, at first closed and spherical, then expanded and concave, and at length almost plane, margin obtuse, disc shining, 5-6 mm. broad. Asci club-shaped, obtuse, slightly stalked, eight-spored 65-88 × 10-11μ; spores crowded together, rod-shaped, generally attenuated at the ends, flexuous, simple or becoming 5-7 pseudo-septate, 20-52 × 3-4·5μ; paraphyses filiform, slender, enlarged at the apex and becoming fuscous and joined together.

Spermogonia wartshaped, black, minute; spermatia oblong, simple, uncoloured 4 × 1·5μ.

On dead branches of Abies excelsa, Dunkeld, Perthshire, 20th July, 1906, Mr. C. McIntosh.

The Asci in the Scotch gathering of this plant measured 80-95 × 13-15μ, the paraphyses 75-85 × 3μ and the ascospores 60-70 × 3-4μ.

Lepiota Bucknalli B. & Br.

This species was first discovered at Clifton by Mr. Cedric Bucknall and it has since been recorded from Studley Royal, Yorkshire in 1881 (Tr. Y.N.U. IX. p. 211); Ledbury and Holme Lacy, Herefordshire (Fl. of Herefordshire 1889, p. 446); Potridings Wood and Kiveton Park, Yorkshire (Fung. Fl. of York, p. 24); at Wolverley, near Kidderminster, Worcestershire (Tr. Worces. Nats. Club, vol. III., p. 277); and in the neighbourhood of Grange Park, Hampshire (List of Fungi of Grange Park, Eyre, 1907).

Collybia mephitica Fr. Hym. Eur. p. 126, Fr. Mon. p. 172 and see pl. 14 hereof

Pileus fleshy, convex, subumbonate, 1·5-4 cm. broad, hygrophanous, greyish ochre becoming whitish, smooth, dry, *adpressedly and innately silky*. Stem 5-7 cm. long by 2-5 mm thick, *filiform*, equal, enlarged at the base, which is covered with the white mycelium, *obsoletely hollow, rigid, grey, pruinosely velvety with white flocci*. Flesh yellowish. Gills obtusely adnate, separating from the stem, attenuated in front, from 4-7 mm. broad, grey, crowded. Smell strong of new meal. Spores pruniform 7-8 × 4μ, white.

* The identity of these specimens was kindly determined by Monsieur Emile Boudier.

Amongst Pine needles, Lawn Wood, Swarraton, Hampshire, 28th October, 1904. C.R.

Easily distinguished amongst the strong smelling species of Collybiae by the grey stem being everywhere covered with white flocci.

Chlorospora Eyrei Mass. (= Schulzeria Eyrei Mass. Grevillea vol. 22, p. 38, pl. 185.

This very distinct and interesting species was discovered by the Rev. W. L. W. Eyre at Alresford, Hampshire, in 1893, and he again found some specimens there in October, 1906. In 1901 it was recorded at the Fungus Foray of the Yorkshire Naturalists' Union from Potridings Wood, and on the 12th of October, 1906, Mr. E. W. Swanton gathered it on Heyshott Downs, Sussex.

Entoloma pulvereum Rea. See pl. 14 hereof.

Pileus 5-30 mm. broad, campanulate, then expanded and flattened, fuliginous, densely covered with *very minute scales*, which are erect at the centre, striate at first, margin very slightly incurved. Flesh thin fuliginous. Stem 25-50 mm. long, 2-3 mm. thick, stuffed at length hollow, equal, densely velvety and *covered when young with a reddish rust coloured meal* which becomes darker with age, externally and internally fuliginous. Gills adnate with a minute sinus, 2-5 mm. wide, grey at length dusted with the pinkish ferruginous spores, *veined*, somewhat distant, *exceeding the margin of the pileus*, edge irregular, thick, pale or pinkish at first, then deep rose colour. Spores pinkish ferruginous, irregular, angular, 12-13 × 6μ. Inodorous.

Amongst oak leaves under a holly tree. Preston Oak Hills, Hampshire, 13th October, 1905. Carleton Rea.

Easily distinguished amongst the Leptonidei group of Entolomata by the reddish rust coloured meal on the stem, the minute scales on the pileus which give it a farinaceous appearance and the veined gills exceeding the margin of the pileus. It should come next after *Entoloma griseocyaneum* Fr.

Coprinus tuberosus Quélet. Bull. Soc. Bot. France XXIV. (1877), p. 289, pl. 3.

On dung, Kew Gardens. The Wild Fauna and Flora of the Roy. Bot. Gardens, Kew, 1906, p. 128.

Hebeloma subsaponaceum Karst.

Allerthorpe Common, near Pocklington, Y.N.U. Excursion August, 1905. Massee and Crossland. Naturalist, January 1906, p. 7.

Cantharellus hypnorum Boud. Rév. Myc. 1892 p. 65.

Ferrymoor, near Cudworth. Y.N.U. Excursion, September 1905. E. Snelgrove. Naturalist, Jan. 1906, pp. 7-8.

Polyporus leucomelas (Pers.) Fr. Stev. Brit. Fun. p. 187. Mass. Brit. Fung. Fl. vol. I., p. 229, and see pl. 15 hereof.

The spores are white, hyaline, warted, spherical × 5-6μ.

This species has up to the present time only been recorded as British from Rothiemurchus Forest, where it was discovered by the Rev. Dr. Keith in 1876, and subsequently by Mr. Angus Grant in 1901 and 1906.

Polyporus arcularius (Batsch) Fr. Hym. Eur. p. 526. Syst. Myc. I p 342, and see pl. 16 hereof.

Pileus 1-3 cm. broad, pliant then coriaceous, somewhat umbilicate, zoneless, in the *first year covered with fuscous squamules*, in the second becoming glabrous and yellow *margin strigose*. Stem 10-25 mm. long 1-2 mm. thick, somewhat squamulose, greyish fuscous or bistre. Flesh white. Pores *oblong, rhomboidal*, thin, rather large, entire, whitish at length becoming fulvous. Spores round × 3μ, white.

On a dead twig, Faskally, near Pitlochry, Perthshire, 27th September, 1906. Mrs. Carleton Rea.

Easily distinguished from *Polyporus brumalis* Fr. by the shape of the pores, the strigose margin and fuscous squamules on the pileus.

Polyporus nodulosus Fr. Hym. Eur. p. 566, Ed. I. p. 474. Icon. t. 187, f. 2, and see pl. 16 hereof.

Pileus 1-3 cm. wide *triquetrous* and *nodular*, corky, woody, *not zoned, villous, rugose, rough*, fulvous then rust coloured. Flesh very hard, lighter in colour. Pores 1-5 mm. long, short, roundish, unequal, acutely torn, light cinnamon with a silvery sheen. Spores white, ellipsoid 4-5 × 3μ.

On a dead erect beech, south slope of Heyshott Down, near Midhurst, Sussex, October, 1906, Mr. E. W. Swanton.

Easily distinguished from *Polyporus radiatus* (Sow.) Fr. by the pores of the nodular pilei becoming confluent, by the absence of the brightly coloured margin of the pileus and by its habitat on beech.

Trametes rubescens (A. & S.) Fr. Hym. Eur. p. 584. Ed. I. p. 492. Alb. & Sch., p. 238, t. 11, f. 2, and see pl. 16 hereof.

White pruinose at first, *then reddening everywhere*. Pileus 5-10 cm. wide, 2-6 cm. deep, 1-2 cm. thick at the point of attach-

ment, semicircular, pubescent, at length becoming zoned towards the margin. Flesh corky, tough, light wood colour, then reddening. Pores 1-3 mm. long, linear, narrow, obtuse, sometimes round, white then blood coloured. Spores
Scentless.

On trunk of Salix Caprea hanging over a pool near Willey Hall, Salop, 12th August, 1906, Mr. W. B. Allen. For his distinctions see p. 161 hereof.

Hypochnus violeus Quél. Ass. Fr. 1882. Fl. Myc. p. 2.

Broadly effused, thin, byssoid. Hymenium rosy lilac with the circumference brighter coloured, minutely tomentoso-velvety. Spores elliptical $6 \times 4\mu$, white, hyaline.

On dead wood Swarraton Rectory, 27th December, 1903, the Rev. W. L. W. Eyre.

Lycoperdon cruciatum Rost.

On the ground among hazel bushes. Massee and Crossland. Naturalist, January, 1906, pp. 6 and 7, 3 figs.

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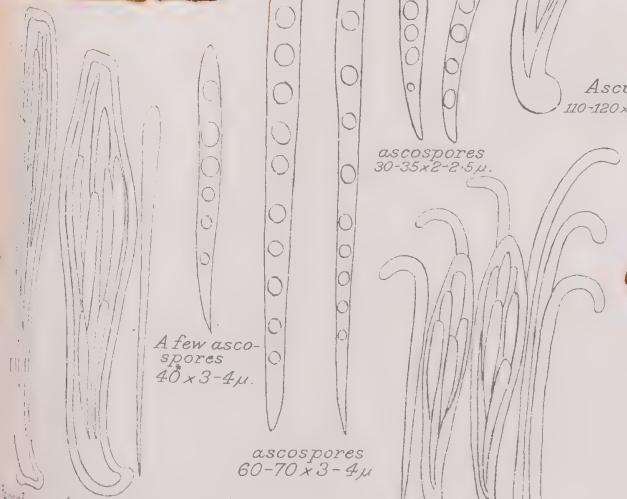
Entoloma pulvereum *Rea.*

Collybia mephitica *Fr.*

Orifice of pores.

Polyporus leucomelas (Pers.) Fr.



×5-6 μ.

Ascus 110-120×11-12 μ.

ascospores 30-35×2-2·5 μ.

A few ascospores 40×3-4 μ.

ascospores 60-70×3-4 μ

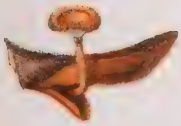
Asci 60-95×13-15 μ.

Paraphyses 120-130×2 μ.

Cudonia confusa Bres.

Scleroderris bacillifera (Karst.) Sacc.

West, Newman chr.



×

Orifice of pores

x 3 μ.

Polyporus arcularius (Batsch) Fr.

Orifice of pores.

4-5 × 3 μ.

Polyporus nodulosus Fr.

Orifice of pores.

Trametes rubescens (A & S) Fr.

F. A. Mead del.

West, Newman chr.

British Mycological Society.

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* Ordinary Members are denoted by an asterisk after the number.

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RULES.

Society's name and objects.

1. The Society shall be called "The British Mycological Society" and its objects shall be the study of Mycology in all its branches, systematic, morphological and pathological, the publication of annual reports recording all recent discoveries in any branch of mycology, and more especially giving a brief synopsis of the work of European Mycologists and the recent additions to the British Fungus Flora.

Members of Society.

2. The Society shall consist of Foundation Members, Honorary Members and Ordinary Members, the number of Foundation Members shall be limited to 100 and that of Honorary Members to 20, but the number of Ordinary Members shall be unlimited.

Foundation Members.

3. Foundation Members shall consist of those Members and Clubs who joined the Society previous to the limit of 100 Members of the Society having been attained, but after this number has been attained no Person or Club shall be admitted as a Foundation Member.

Honorary Members.

4. Honorary Members shall be Ladies or Gentlemen of pre-eminence in Mycology, or who have rendered special service to the Society.

Ordinary Members.

5. Ordinary Members shall be Ladies or Gentlemen elected as hereinafter set out.

Election of Members.

6. Until the limit of 100 Foundation Members be reached any person or Club may signify their desire of joining the British Mycological Society and will consequently be enrolled as Members thereof by the Secretary. Honorary Members shall only be elected

at a meeting of The British Mycological Society by the majority of the Members then present. Ordinary Members shall be elected either by the majority of the Members then present at the annual meeting, or meetings, or by the President, Vice-President, Treasurer, and Hon. Secretary at other times. All Ordinary Members shall be proposed and seconded respectively by existing Members, who shall sign a certificate (see appendix) in recommendation of him or her, one at least of the proposers so certifying from personal knowledge, and every candidate for election shall sign an undertaking to abide by the Rules if elected (see appendix).

Yearly Subscription.

7. All Ordinary Members and Clubs shall pay an annual subscription of 10/- and Foundation Members 5/-, and the same shall be due by the First of January in each year, whilst Honorary Members shall be exempt from any annual subscription. Any Member wishing to retire from the Society shall give notice to the Hon. Secretary in writing before 1st of December of the previous year, otherwise he shall be liable for the annual subscription for the next year.

Government of the Society.

8. The management of the British Mycological Society shall be vested in the President, Vice-President, Treasurer, and Hon. Secretary.

Election of Officers.

9. The President, Vice-President, Treasurer, and Hon. Secretary shall be elected annually, at the first meeting of the British Mycological Society in each year, by a majority of the Members then present.

Meetings or Forays.

10. The British Mycological Society shall hold one or more meetings annually at a place and time determined by the Members at the previous meeting, or in default thereof, by the President, Vice-President, Treasurer, and Secretary. Invitation from Local Societies shall be first entertained and the acceptance of such shall imply that the Local Society undertakes to arrange the excursions of the foray, obtain necessary permissions from landowners, and place at the disposal of the British Mycological

Society a room, free of cost, for the exhibition of specimens, delivery of addresses, and the transaction of business.

Accounts to be annually furnished and vouched.

11. At the first meeting of the British Mycological Society in each year the Hon. Secretary shall produce an account of the receipts and disbursements for the previous year duly vouched by the Hon. Treasurer, or if the two offices be combined, then by an independent Member of the Society.

Payment of Expenses.

12. At each Meeting the Members then present must pay to the Hon. Secretary their share of the expenses incurred.

Election of Chairman in absence of President and Vice-President.

13. In the absence of the President and Vice-President, the Members present at any meeting shall elect a Chairman for that Meeting.

Rarities to be recorded.

14. Members finding rare specimens, or specimens new to the British Fungus Flora, are requested to immediately communicate the fact to the Hon. Secretary, together with full descriptions, the locality, habitat, and the date thereof, and the Hon. Secretary shall report the same at the next meeting of the Society.

Every Member to have a copy of these Rules and any alteration thereof.

15. A printed copy of these Rules shall be sent to every Member of the Society on election, and to all Members on their alteration.

APPENDIX.

Form of proposal for Ordinary Membership of the British Mycological Society.

_____

of _____

_____

being desirous of becoming an Ordinary Member of the British Mycological Society, we, the undersigned Members of the Society, certify that we consider h to be a desirable Member of the Society, and beg to recommend h for election.

Dated this day of 19

_____ (From personal knowledge).

_____

Certificate to be signed by the Candidate.

I hereby certify that I desire to become an Ordinary Member of the British Mycological Society and that I will abide by the Rules if elected.

_____

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